MAC 1100/1200
Servicing Instructions

Version 1.1
227 492 20 SA(e) Revision D

marquette

A GE Medical Systems Company

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During repairs/service interventions, observe the protective measures against damage due to ESD.

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  - the instrument is used in accordance with the instructions for use.

* This manual contains service information; operating instructions are provided in the user manual of the instrument.

* This manual is in conformity with the instrument at printing date.

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Revision History

Each page of this manual has the document number followed by a revision letter, located at the top of the page. This letter identifies the manual update level. The latest letter of the alphabet corresponds to the most current version of the document.

The revision history of this manual is summarized below.

Date	ECO No	Revision	Remarks
March 05,1999		A	V 1.0, initial release
May 10, 1999	062 136	B	Software Package for MAC 1100/1200 (Software change) page 55, new MRI
June 29, 1999	062727	C	Pin 4 – Coding pin, page 19, Supplementation to chapter 3.4; page 29 Software Release V 5.02 page 55, new MRI, PCB Control CS_CI , Sheet 9 new Index PCB Control CS_C, new Index PCB Battery Charge CS_CI, new Index
February 4, 2000	062920	D	Device Version V1.1 with Remote Start Input, internal Modem Supply (MAC1200 US device only) and Software Release V5.1

1 Device description

This Service Manual describes device version **V1.1 of MAC1100 and MAC1200**.

The **MAC1100** is a portable electrocardiograph with an integrated printing unit. They are used to acquire, record and process ECG signals.

The integrated LCD graphics Display shows 3 ECG channels. It also displays status information, filter settings, speed/format, gain and the status of the electrodes.

With the setup feature, the user is able to setup the device and the modes for his own needs.

The MAC1100 offers 2 modes of operation: Automatic (12-lead) and Manual (6-lead).
Transmission of one in the automatic mode aquired ECG to the MUSE or CardioSys system directly or via a modem.

It is designed for line-power operation.
In addition, a NC-battery with a charging circuit can be integrated into the instrument as a separate option.

In addition, a pump for the KISS system can be integrated into the instrument as a separate option.

The patient cable for the acquisition of ECG signals is connected by means of a 15-pin connector as used with MAC 500. Patient cables used with MAC 1000 cannot be connected to the MAC 1200.

The **MAC1200** has all features of the MAC1100, in addition, the following features are included:

- NC battery with charging circuit is integrated in general
- Arrhythmia as third mode of operation
- Automatic mode with CSI protocol for transmission
- Automatic mode with interpretation (Option)
- Automatic mode with storage for up to 40 ECGs (option)
  The acquired ECGs can be transmitted to MUSE or CardioSys directly or via a Modem.

MAC1100/1200 with version **V1.1** has all features of the version V1.0 described above, additionally version V1.1 has a **Remote Start Input**, an **internal Modem Power Supply** (MAC1200 US device only) and the new **Software Release V5.1.**

Variants of the MAC1100/1200

The complete list of the variants is included in **Section 8 "Parts List".**

The following table gives an overview of the different device models of the MAC1100/1200.

With version V1.1, **the ASIA device models** are identical to the INTERNATIONAL device models, because the Manufacturer ID is GE marquette in general now, so special ASIA device models **are not required any longer.**

Device	Device Model	Manufacturer ID	Keypad	Labeling	Mains Voltage
MAC1100 MAC1200	INT	GE marquette	Icons	International	230V
MAC1100 MAC1200	Europe 2	GE marquette	Text	International	230V
MAC1200	USA	GE marquette	Text	USA	115V
MAC1100 MAC1200	RUSS	GE marquette	Kyrillian	International	230V

Hardware functional blocks:

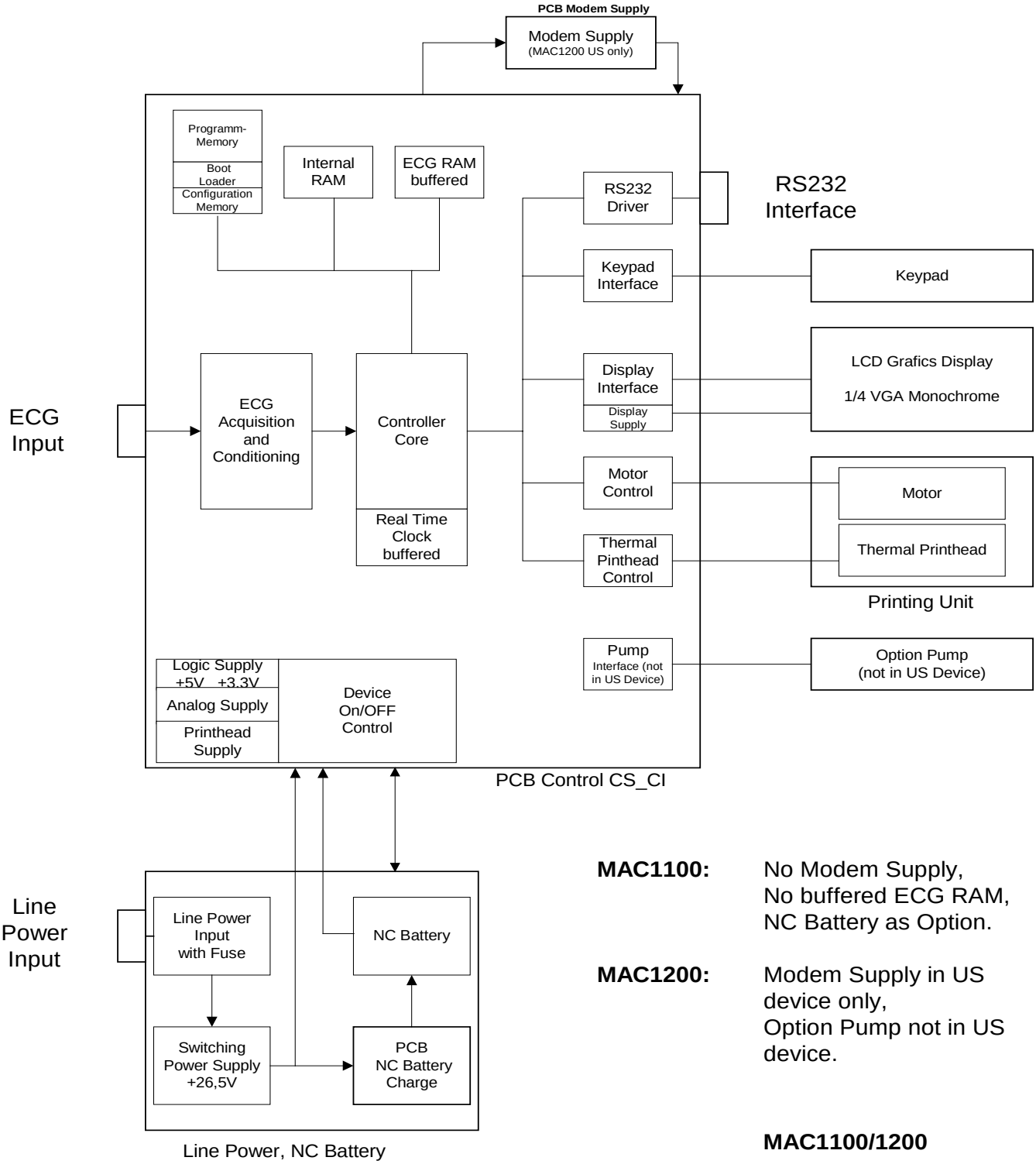
MAC1100 and MAC1200 comprises of the same hardware functional blocks. Differences between both are mentioned.
List of the main functional blocks:

- Switching power supply
- NC Battery *for MAC1100 only as an option*
- PCB NC Battery charge *for MAC1100 only as an option*
- PCB Control CS_CI
- PCB Modem Supply CS_M *for MAC1200 US device only, from version V1.1*
- Printing unit
- Keypad
- ¼ VGA graphics display, monochrome

The description of the functional blocks is valid for MAC1100 and MAC1200. Differences between MAC1100 and MAC1200 in single functional blocks are mentioned within the description of such blocks.

1.1 Block circuit diagram of entire instrument

MAC1100/1200 Version V1.1



MAC1100: No Modem Supply,
No buffered ECG RAM,
NC Battery as Option.

MAC1200: Modem Supply in US device only,
Option Pump not in US device.

MAC1100/1200

V 1.1
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1.2 Mechanical components

The main mechanical components comprise the **upper and lower shell** of the **MAC1100/1200.**
The lower shell serves as a basic unit to receive the following assemblies:

- Line power input module with fuse
- Switching power supply
- NC Battery
- PCB NC Battery Charge
- PCB Control CS_CI
- PCB Modem Supply CS_M
- Graphics display
- Thermal printing unit
- Paper container

The upper shell accommodates the keypad, which is connected to the PCB Control CS_CI via a 26-pin connector.

The MAC1100/1200 can be opened by releasing 5 screws at the bottom of the lower shell, opening the paper flap and lifting up the upper shell a little bit to remove the keypad cable from the PCB Control CS_CI. The upper shell then can be removed completely.

To replace the NC Battery, the battery flap at the bottom of the lower shell must first be unlocked with a screw-driver before it can be removed.

The 15-pin input connector to connect the **patient cable** and the 9-pin connector for the **RS-232 interface** are located directly on the PCB Control CS_CI.

2 Functional description

The block circuit diagram of the entire instrument in Section 1.1 and the functional blocks of circuit diagram sheets (P-plans) describe the individual functional blocks.

2.1 Switching power supply

The switching power supply generates the fundamental device voltage for the PCB Control CS_CI and for the PCB NC Battery Charge.

It has the following input specifications:

Input voltage range:	85 ... 264V ac
Line frequency range:	47 ... 65 Hz

The output voltage is +26.5 V dc, the maximum load is 1.5A.

2.2 PCB NC Battery Charge

MAC1200 and MAC1100 with the option “Battery” can operate battery powered. With a new, fully charged NC battery, in Automatic Mode up to 50 ECG can be recorded.

The PCB NC Battery Charge, controls and monitors the charging process, depending on the status of the battery and the status of the device.

Section 2.2.1 and 2.2.2 is not valid for MAC1100 without option “Battery”.

2.2.1 Charging circuit for the NC battery

An integrated charging device is used to charge the battery. During charging it monitors the battery voltage function and switches over from rapid charging to trickle charging.

Applying the line power to the MAC 1200, or insertion of the battery activates the charging circuit.
During a recording, the charging current is reduced.
In standby mode, a depleted battery is fully charged within 4 hours.

2.2.2 Device behavior depending on the state of battery charge

Depending on the status of the battery and the status of the device, the following behavior occurs:

State1: *Battery depleted, line power supply is connected up:*
Battery charged in rapid mode; when fully charged, switchover to trickle charging.

State 2: *Battery full, line power supply is connected up:*
Battery charged in rapid mode for some minutes till the charging circuit recognizes “battery full“, then switchover to trickle charging.

State 3: *Battery depleted, no line power supply, device is switched on:*
Device inoperative.

State 4: *Battery full, no line power supply, device is switched on*:
Device fully operative.
When battery is almost depleded, the LEDBAT signal is activated to Indicate that the device should be charged by connecting to the line power supply. If the operation is continued without line power, MAC 1200 will shut down itself when a minimum level is reached to prevent the battery from a excessive discharge.

State 5: *Battery depleted, line power supply is connected up, device is switched on:*
Battery is charged in rapid mode, device is fully operative, including recording.
During recording, the charging current is reduced. If in this phase, a lot of recordings take place, the battery is not fully charged within 4 hours.

2.3 PCB Control CS_CI

The PCB Control CS_CI is the mainboard of the MAC 1200, the PCB Control CS_C is the mainboard of the MAC1100, which has not all memory circuit mounted. The mainboard accommodates the control functions of the device, except the line power supply and the NC battery-charging controller.

2.3.1 Generation of internal power supplies

Logic power supply + 5V and + 3.3V

The processor core and the memory is a fully + 3.3V design.
The interface functions to display, to RS-232, to the printing unit and to the ECG acquisition unit are supplied with + 5V.

Both the + 3.3V and the + 5V are generated separately by a clock-rated voltage controller. By using the „adjustable version“ of the voltage controller, both supplies are based on the same voltage controller. The output voltage is determined by appropriate dimensioning of the voltage divider at the feedback input of the voltage controller.

Standby supply + 5VSTB and + 3.3VSTB

The standby supply + 5VSTB supplies the ON/OFF Control, the + 3.3VSTB buffers the patient ECG memory when the device is turned off.
Both supplies are generated together from one low-power linear regulator with low quiescent supply current.

Analog supply + 12V

+ 12V is used for the heating control and temperature monitoring of the printing unit, which requires only a current of a few milliamperes.
This supply is generated by a linear regulator with feedback input.

2.3.2 Switch On/Off circuit

The Switch On/Off Circuit consists of the On/Off Control and the Voltage Control.

The **On/Off Control** switches the device on or off by switching the device supplies +UVERS and +USUPPSW.
The On/Off Control is supplied from the + 5VSTB.

Device On Sequence:

The transition from Device Off State, or Standby State when line power is connected to Device On State can only be activated by pressing the On/Off button.

Device Off Sequence:

The transition from Device On State to Device Off State, or Standby State when line power is connected can be achieved as follows:

- pressing the On/Off button
- when the control core activates the signal DEV_OFF,

- when the voltage control applies the signal REG_OFF_, because the battery voltage gets too low during battery operation.

The **Voltage Control** controls the battery voltage during battery operation.

The signal BATT_LEV2 indicates that the battery charge has gone down, and the device should be connected to the line power soon.

The signal BAT_LEV1 indicates that the battery has been discharged almost completely, the device should be connected to the line power immediately, otherwise the device will shut down within few minutes.

If battery discharge is continued without connecting to the line power, the signal REG_OFF_ is activated and the device is switched off.

2.3.3 ECG recording and front-end processing

The patient input is classified as being cardiac floating and is defibrillation-proof.

The patient leads are connected with a 15-pin connector with a special form for the specified and released patient cables for the MAC1100/1200.

The main element of the ECG recording and front-end processing is a set of chips comprising 3 ASICs. Pace detection is realized by a separate circuit.

Every disconnected electrode is detected by a special AC measurement, which allows higher impedance between electrode and patient.

N common-mode compensation ensures suppression of interference, at the same time serving to improve the in-phase suppression of the input electrodes.

To protect patients, the ECG recording and front-end processing are assembled as floating components. Digital signals from and to the controller core are transmitted via opto-electronic couplers. The floating supply +/- 5V is generated by an isolated flyback converter from the + 5V logic power supply.

2.3.4 Controller core

The actual core comprises the Motorola Power PC MPC821, which contains the following integrated components:

- chipselect logic
- DRAM controller
- SCC and SMC for RS-232
- LCD controller
- SPI Interface
- I/O ports
- Real-Time Clock counter register

In addition, the MPC821 contains a JTAG port with test and programming capabilities.

The MPC821 has the following additional power supplies:
- VDDSYN, filtered from the + 3.3V logic supply, for the clock generation.
- KAPWR, generated from the + 3.3V logic supply, or from a battery when device is off, used for buffering the RTC Counter Register.

The **clock generation** for the MPC821 is realized by a quartz oscillator with 32.768KHz. The system clock CLOCKOUT is adjusted with the internal PLL register. The system frequency is 25 MHz.

The **Watchdog /Reset Generation** is implemented separately in an integrated system monitoring chip. It has the following functions:

- Power-up reset for the MPC821 when the device is switched on
- Voltage monitoring of the + 3.3V and + 5V, with reset generation
- Watchdog
- Switchover to battery supply for patient ECG memory when device is switched off
- Signal for access protection for patient ECG memory when device is switched off

The **Reset Configuration** defines startup conditions like boot port size and clock generation source.

Four LEDs indicate the device status in addition:

LED1:	active when a HRESET_ occurs
LED2:	indicator for the logic supply
LED3, LED4:	indicate internal software states

The **control register** comprises device control signals to switch off the device, control battery charging and display control signals.

The **status register** contains information on the device hardware configuration and the state of the battery charge.

2.3.5 Real time clock

Since the internal Real-Time Counter Register of the MPC821 is used, no external Real Time Clock chip is required. The internal RTC Register is buffered by the voltage KAPWR.

2.3.6 Memory

The complete memory of the MAC1100/1200 is located on the PCB Control CS_C(I). The software of the device can be loaded through the JTAG Port during the production process, or for service purposes with the appropriate programming software through the RS-232 interface.

Program Memory:

Type:	Flash, + 3.3V supply	
Organization:	1 Mbit x32, 4 Mbyte	*MAC1100: 0,5Mbit x32, 2 Mbyte*
Waitstates:	1 Waitstate	

DRAM:

Type:	EDO DRAM, + 3.3V supply
Organization:	1 Mbit x32, 4 Mbyte
Waitstates:	0 Waitstate

Patient ECG Memory:

Type:	buffered SRAM, + 3.3V supply	
Organization:	256 Kbit x16, 512Kbyte	*MAC1100: No patient ECG memory*
Waitstates:	1 Waitstate	

Configuration Memory:

The configuration memory is part of the program memory Flash. With special hardware and software protection facilities, write access to the Flash is only possible in the defined configuration memory of the Flash. Thus an external configuration Memory like an EEPROM is not required.

2.3.7 LCD graphics display interface

For the LCD interface to the ¼ VGA monochrome LCD interface, the internal LCD controller of the MPC821 is used.

Controller Interface:

For the digital control signals, delivered from the MPC821, only an output driver is required.

LCD Power Supply:

The LCD power supply VEE of -23V is generated from the +5V logic supply. The generation starts after HRESET_ becomes inactive to ensure that the logic supply of +5V first is applied to the display.

Adjusting Contrast:

Contrast adjustment of the Display is accomplished with the contrast voltage V0. The level of V0 is controlled with the PWM signal BLCD_CONTR from the timer module of the MPC821. In addition, the contrast voltage is temperature compensated.

Backlight:

The LCD backlight converter for the CCFL tube is located on the PCB Control CS_CI too. The backlight converter is generated from the +5V logic power supply. The signal BLCD_ENBA switches the backlight on or off.
The user can define the backlight active time in the configuration menu.

2.3.8 Keypad interface

The keypad interface contains the control register for 8 keypad columns and the receiving register for 7 keypad rows, and the control signals for the status LEDs: LED_LIN, LED_BATT, LED_START and LED_STOP.

Using the matrix of 8 x 7, up to 56 keypads can be detected.

Identification of the key pressed is as follows:
The controller activates a column, activation is via low-level, then the row-register is read to identify the pressed key by a low-level. This procedure is repeated with the next column, till all columns have been activated.

2.3.9 Printhead control

The printhead controller takes on the complete control of the 216-mm thermal printhead with a line width of 200 mm.
The output rate to the printhead is 1000 /sec. The resolution in the Y-direction is 8 dot/mm, in the X- time axis up to 40 dots/mm.

Thermal Printhead Dot Control:

The MPC821 prepares a complete dot column and sends it to the FIFO. A complex PLD reads out a complete column of the FIFO and generates the digital control signals for the printhead, which are shifted in series.

The duration of heating a dot column is defined through the pulse width of the PWM Signal HEAT that is generated from the complex PLD too.
In addition, the duration of heating a dot column is influenced by the thermal printhead monitoring.

Thermal Printhead Temperature Monitoring:

The thermal printhead temperature monitoring measures the temperature of the thermistor, located on the printhead. A constant current source effects a temperature-dependent voltage drop.

If a printhead temperature of 55°C is exceeded, the signal REC_OVHEAT_ is activated and the heating of the printhead is prevented by disabling the signal STROBE.
Only when the printhead temperature drops below 50°C is the signal REC_OVHEAT_ disabled and the heating via the signal STROBE re-enabled.

In addition, a continuous reduction of the heating duration occurs with increasing printhead temperature, resulting in a regular typeface throughout the entire temperature range.

2.3.10 Motor control

Paper transportation for the speeds 5mm/s, 25mm/s and 50mm/s is driven by a stepping motor. The stepping motor is controlled by an integrated stepping motor driver circuit. The current for the motor is adjusted by the sense resistors of the stepping motor driver.

For the speed 5mm/s, the motor current is reduced, triggered by the signal LOW_SPEED.

The motor speed is controlled by the frequency of the signal RECTMR_STEP, which is generated by the timer unit of the MPC821.
The driver circuit is enabled by the signal REC_MOTEN, the driver is powered from +22,5V.

2.3.11 RS-232 interface

The MAC1100/1200 has an RS-232 interface accessible with a 9-pin Sub-D connector.
Except for the RS-232 driver chip, the interface is integrated into the control core of the MPC821.

The interface has the following attributes:
- hardware handshake with the signals RTS and CTS
- or software handshake with XON/XOFF
- transmission speeds from 4800 ... 38400 Baud
- maximum input voltage range: +/- 15V
- minimum driver output voltage: +/- 5V
- maximum ESD interface protection: +/- 10kV

From version V1.1, MAC1100/1200 additionally provides a remote start input on the RS-232 interface. The MAC1200 US device additionally provides a modem power supply output on the RS-232 Interface.

2.3.12 Buzzer

The buzzer is an integrated signal generator with fixed frequency, directly operating from the +5V logic power supply.
Activating and deactivating is controlled with the signal SPEAKER.

2.4 PCB Modem Supply CS_M

PCB Modem Supply CS_M generates a supply voltage of +8V dc, to operate a special GE marquette modem direct on the RS-232 interface on the MAC1200 without the need of an external power supply for the modem.

The Voltage is generated by a switching regulator with current limit and thermal protection from the +26,5V.
The modem supply voltage +8V is accessible on Pin 6 of the RS232 interface.
The protection against ESD is realized with a Transzorb diode on the PCB Control CS_CI

.

2.5 Internal interfaces

2.5.1 Mechanical interfaces

Mechanical interfaces are described in Section “1.2 Mechanical Components“.

2.5.2 Electronic interfaces

This section describes the pinning, function and significance of the signals on the internal interfaces of the functional components.

2.5.2.1 Interface to the switching power supply

The interface to the switching power supply is realized by the connector POSUP/ on the PCB Control CS_CI.

Connector denotation: **POSUP/**

Type: male connector 1 X 4-pin., 180°, AMP MODU I

reverse terminal protection achieved mechanically.

The function of the individual pins is given in the following table . The definition as an input/output is seen with reference to PCB Control CS_CI.

POSUP/

Pin Number	Signal Name	input/output	Function	Definition
1	+24VPS	Input	Voltage from power sup.	+ 26,5V
2	+24VPS	Input	Voltage from power sup.	+ 26,5V
3	GNDPS	Input	GND from power supply	
4	GNDPS	Input	GND from power supply	

2.5.2.2 Interface to the PCB NC battery charge

This interface has the supply for battery charging, charging control and status signals and the battery voltage from the PCB NC battery charge.

Connector denotation: **BATT/**
Type: male multipoint connector 2x 10-pin, 180°

reverse terminal protection and coding with coding pin 15

The function of the individual pins is given in the following table . The definition as an input/output is seen with reference to PCB Control CS_CI.

BATT/

Pin Number	Signal	input/output	Function	Definition
1	+24V	Output	Supply battery charging	
2	+24V	Output	Supply battery charging	
3	+24V	Output	Supply battery charging	
4	Code		Coding Pin	
5	NC			
6	GND24V		common Ground	
7	GND24V		from power supply	
8	GND24V		after ferrite decoupling	
9	GND24V			
10	+UBATT	Input	Battery voltage	
11	+UBATT	Input	Battery voltage	
12	+UBATT	Input	Battery voltage	
13	+UBATT	Input	Battery voltage	
14	+UBATT_ME	Input	Battery measuring output	
15	Code		Coding Pin	
16	+5V_L	Output	+ 5V supply	
17	NC			
18	BATT_OPT_	Input	Status option battery	“0“: option active
19	LOAD_OFF	Output	Charging reduction	“1“: reduced charging
20	NC			

2.5.2.3 Interface to the LCD Graphics Display

The interface to the LCD graphics display provides the LCD data signals, the display supply voltages +5V and VEE, the display contrast voltage V0 and the display on/off control signal.

Connector denotation: **HOS/**

Type: Foil connector, 14- pin, zero power insertion, 180°

The LCD supply voltage VEE can be measured at R 731 on the PCB Control CS_CI, the LCD contrast voltage can be measured at R 730. Both levels of these voltages depend on the contrast selected.

The voltage supply for the CCFL tube of the display is provided separately via the connector **BL/.**
Caution! Do not touch! High AC voltage!

2.5.2.4 Interface to the keypad

The interface to the keypad is realized with the connector KEYB/. It contains the signals for the keypad rows and columns, the supply and the control signals for the status LEDs of the keypad. The foil connecting cable is part of the keypad itself.

Connector denotation: **KEYB/**

Type: Foil connector, 26- pin, zero power insertion, 180°, grid 1.0mm, Molex

2.5.2.5 Interface to the printhead

The control data to the printhead is transferred via the flexible PCB Printhead Connection, plugged into the connector TPC_DAT/ on the PCB Control CS_CI.

Connector denotation: **TPC_DAT/**

Type: male connector 1x 20-pin, 180°

Printhead Supply

The printhead is supplied through a 6-pin connection cable, plugged to the connector TPC_PO/ on the PCB Control CS_CI.

Connector denotation: **TPC_PO/**

Type: multipoint connector 1 X 6 pin., 180°, reverse terminal protection, MODU II

The function of the individual pins is given in the following table . The definition as an input/output is seen with reference to PCB Control CS_CI.

TPC_PO/

Pin Number	Signal	input/output	Function	Definition
6	COMMON		Supply Voltage +22,5V	
5	GNDITPC		Ground	
4	COMMON		Supply Voltage +22,5V	
3	COMMON		Supply Voltage +22,5V	
2	GNDITPC		Ground	
1	VDD1		Auxiliary Voltage	

2.5.2.6 Interface to the motor

The motor control signals are supplied through a 6-pin connection cable, plugged to the connector MOTOR/ on the PCB Control CS_CI.

Connector denotation: **MOTOR/**

Type: multipoint connector 1 X 6 pin., 180°,
reverse terminal protection, MODU II

2.5.2.7 Interfaces for production tests

Debug Port

The debug port is an interface for developing purposes. With the corresponding tools, the MPC821 can be set to the debug mode, to show internal states.

Connector denotation: **BDM/**

Type: male connector, 2x 5- pin, 180 °

JTAG Port

The JTAG is an interface for the production test of the processor core and the memory. In addition, the Flash memories can be programmed with this interface.

Connector denotation: **JTAG/**

Type: male connector, 2x 5-pin, 180 °, pin 7: coding pin

The function of the individual pins is given in the following table. The definition as an input/output is seen with reference to PCB Control CS_CI.

JTAG/

Pin Number	Signal	input/output	Function	Definition
1	TMS	Input	JTAG Test Mode Select	
2	TRST	Input	Reset for Scan Chain	“0“: Reset active
3	TDI	Input	Data In for JTAG Mode	
4	TDO	Output	Data Out for JTAG Mode	
5	TCK	Input	Serial Clock for JTAG	
6	GND		Logic Ground	
7	PORESET	Bi-direct	Power On Reset	“0“: Reset active
8	EN_BJHRES	Input	Enable buffered HRESET	“0“: HRESET enabled.
9	WE0_IORD	Bi-direct	Write Enable Flash upper	“0” : Write enable
10	WE1_PCDE	Bi-direct	Write Enable Flash lower	“0” : Write enable

In Circuit Programming Port

With the In Circuit Programming Port, both CPLDs can be programmed or updated in a Daisy Chain queue.

Connector denotation: **ISP/**

Type: male connector, 2x 5-pin, 180 °, pin 4: coding pin

The function of the individual pins is given in the following table . The definition as an input/output is seen with reference to PCB Control CS_CI.

ISP/

Pin Number	Signal	input/output	Function	Definition
1	ISP_SCLK	Input	Serial ISP Clock	
2	GND		Logic Ground	
3	ISP_MODE	Input	ISP Mode Select	
4	Code		Coding pin	
5	ISP_EN	Input	Enable In Circuit program.	“0“: ISP enable
6	ISP_SDI	Input	Serial Data In	
7	ISP_SDO	Output	Serial Data Out	
8	+5V		Logic supply	
9	NC			
10	NC			

.

2.5.2.8 Interface to PCB Modem Supply CS_M

The interface to PCB Modem Supply CS_M is realized by the connectors MO_SU/ and RS232_E/.

MO_SU/ delivers the voltage +26,5 for the modem supply generation, RS232_E/ receives the generated modem voltage +8V for the PCB Control CS_CI.

Connector denotation: **MO_SU/**

Type: multipoint connector 1 X 3 pin., 180°,

reverse terminal protection, MODU II

The function of the individual pins is given in the following table . The definition as an input/output is seen with reference to PCB Control CS_CI.

MO_SU/

Pin Number	Signal	input/output	Function	Definition
1	+UVERS	Output	Supply Voltage + 26,5V	
2	EN_MOSU	Output	Enable Modem Supply	Open, high: enable Low: disable
3	GND24V	Output	Ground	

Connector denotation: **RS232_E/**

Type: male connector, 2x 5-pin, 180 °

The function of the individual pins is given in the following table . The definition as an input/output is seen with reference to PCB Control CS_CI.

RS232_E/

Pin Number	Signal	input/output	Function	Definition
1	+5V	Output	Logic Supply	Reserved
2	+5V	Output	Logic Supply	Reserved
3	GND		Ground	
4	GND		Ground	
5	SMRXD1	Input	Receive (RXD)	Reserved
6	SMTXD1	Output	Transmit (TXD)	Reserved
7	GND		Ground	
8	**V_MODEM**	**Input**	**Modem Supply +8V**	
9	EKGTRIG_E	Output	ECG Trigger	Reserved
10	FERNST_E	Input	Remote Start Input	Reserved

2.6 Interfaces to peripherals

The MAC1200 has only 3 interfaces for peripherals:

- Mains input
- Patient input
- RS-232 interface

The **mains input** interface on the device is a 3-pin standard cold appliance socket connection, which is integrated into the mains input module. Connection to the mains is effected via a 3-pin power cord with a non-fused earth conductor.

The mains input is a wide range input from 95Vac ... 240Vac. The mains input module contains the two primary fuses.

When replacing these fuses, the following points have to be observed:

- replacement by factory or servicing agent only!
- disconnect mains plug!
- replacement only with the original fuses!

For the **patient input**, the mechanics of the patient input of the MAC500 is used, so the patient cables of the MAC1000/CardioSmart cannot be used for the MAC1200.

A 9-pin sub-D Connector, type Mark II with 4-40 UNC inserts, with a standard configuration of the signals TXD, RXD and GND is implemented in the construction of the **RS-232 interface**.

2.6.1 Electronic interfaces

2.6.1.1 RS-232 interface

The 9-pin sub-D Connector of the RS-232 interface is implemented on the PCB Control CS_CI directly.

From Version V1.1, the remote start input pin is available on pin 8.
In MAC1200 US devices the modem supply output +8V is available on pin 6 additionally.

Connector denotation: **RS232/**

Type: 9-pin sub-D, female, Mark II with 4-40 UNC inserts

The function of the individual pins is given in the following table . The definition as an input/output is seen with reference to PCB Control CS_CI.

RS232/

Pin Number	Signal	input/output	Function	Definition
1	NC			
2	RXDE	Input	RS232 Data In	
3	TXDE	Output	RS232 Data Out	
4	NC			
5	GND		Signal Ground	
6	**V_MODEM**	**Output**	**Modem Supply +8V**	**MAC1200 US only**
7	RTSE	Output	Request to Send	
8	**FERNST**	**Input**	**Remote Start Input**	**“0” : active**
9	NC			

2.6.1.2 Patient input

The connection to the patient cable is realized with a 15-pin female sub-D Connector, implemented on the PCB Control CS_CI directly. The mechanical plastic housing makes sure that for MAC1100/1200 only released patient cables can be connected.

Connector denotation: **EKG/**

Type: 15-pin sub-D, female

EKG/

Pin Number	Signal	input/output	Function	Definition
1	C2	Input	chest lead V2	
2	C3	Input	chest lead V3	
3	C4	Input	chest lead V4	
4	C5	Input	chest lead V5	
5	C6	Input	chest lead V6	
6	Shielding	Output	shielding AVSS	
7	Cable	Input	Identification: patient cable used	“0“: patient cable used
8	Cable identification	Input	5/10 -pin or 12 -pin cable used	“0“: 12-pin cable “1“: 5- or. 10-pin cable.
9	R (RA)	Input	electrode right arm	
10	L (LA)	Input	electrode left arm	
11	F (LL)	Input	electrode left leg	
12	C1	Input	chest lead V2	
13	NST	Input	Nehb electrode NST	
14	N (RF)	Output	electrode right leg	
15	NAX	Input	Nehb electrode NAX	

2.7 Software Updates

Software updating can be performed via RS232 with the Software **Download Kit part-No. 2000079-001**. The required connection cable and a description of the procedure is included in the kit.

2.8 Limitations

The following operating modes are not implemented in the MAC1100/1200:

- No ergometry
- No SAO2
- No spirometry
- No late potentials, no RR variability
- No phono, no US Doppler

A scope output is not available.

No analog inputs.

No ECG trigger output.

Lead acid accumulators cannot be used.

Primary cells cannot be used.

3 System test functions

All messages displayed during the self-test are in English.

3.1 General information

The functions for the system test are mostly menu-guided.

For complete execution some tests require special auxiliary resources. These include interface testers or PC, connection cables, signal generators, etc. The tests that are necessary are described in the various test descriptions.

3.2 Test start

After simultaneously pressing the keys

Shift + 12 Lead (or Auto)

the initial display menu appears to enable selection of a specific test. (see below)
The specific test functions are activated by pressing the corresponding key.

Hardware tests

1= Display test
2 = Keyboard
3= Motor test
4= Test results
5= Recording test
6= V24 tests
7= Time and date
8= Electrode test
9= Time constant
D= Device model
H= Interpretation
P= Pace enhance
N= Serial number

X= End (Terminate hardware tests)

3.3 Display test

After pressing the **“1" key** the following menu appears:

Display test

(1) Test pattern
(2) Clear display
(3) Restore menu
(4) Inverse
(5) Display illumination
Contrast control
- Shift_Cursor_Down
- Shift_Cursor_Up

Terminate with any key

Pressing any other key than one of those listed in the menu above leads back to the initial display menu.

(1) Test pattern

Pressing this key generates a chessboard pattern. Each subsequent pressing generates the inverse display of its predecessor.

(2) Clear display

All display pixels are inactive

(3) Restore menu

The initial display test menu is displayed.

(4) Inverse

The contents of the existing display appear in reverse video.

(5) Display illumination

The illumination is switched on or off by pressing this key.

Contrast control
The contrast setting can always be adjusted as described above (cursor keys).

3.4 Keyboard test

By pressing the **“2" key** the following menu appears:

Key T e s t

B= Bleeper test

E= End

When a key is pressed this key or its function is displayed. This can either occur by a triple character display, e.g., “AAA” or as a text, e.g., "CURS_UP". Moreover, pressing the “B” key tests the bleeper (audible sound). The keys “ALT” and “SHIFT” only in combination with another key. The “E” key terminates this test and simultaneously undergoes a self-test.

3.5 Motor test

When the “3" key is pressed the following menu appears:

Motor Speed Test
- Speed selection key
- Start/Stop key

Terminate with any key

The speed select key is used to set the required speed and the motor is set into motion with Start/Stop.
A marking pulse is set once every second. The running speed can then be calculated or its accuracy checked from the distance between marking pulses. Any other key pressed not included in this menu leads to the initial display menu.

3.6 Test results

Pressing the **“4" key** triggers the output of the test results.

The output of the test protocol supplies the following information:

- Time and date
- Device serial number
- Device model
- Software release
- ECG time constant
- Battery voltage
- test results
- Memory used (ROM, RAM)
  - base address
  - size

Following output, the initial display menu reappears automatically.

The identification of the Hardware Version is given by the item “Remote Control yes/no”.
“No” indicates Hardware Version V 1.0 (no remote control), “yes” indicates Hardware Version V 1.1.

This message is intended only for the use of the individual or entity to which it is addressed. As it contains confidential information, any use distribution or copying is strictly prohibited if you are not the addressee.

3.7 Self-test

The test results elucidated in Section 3.6 are ascertained during the self-test, which is always performed on power-up. Should errors be detected, a message appears on the display after the test, indicating the possible errors. The following error codes are used to identify the error.

Error codes

The following error codes appear on the display together with the message “Self-test failed”:

ERROR_CODES:
0 - reserved
1 VEKT - error in vector table
2 DRAM - DRAM error
3 SRAM - SRAM error
4 - reserved
5 - reserved
6 - reserved
7 - reserved

8 ROMB - ROM error (checksum) in the FLASH
9 - not used
10 - not used

3.8 Recording test

The recording test is activated by pressing the **"5" key**.

A window with 2 channels is displayed.

- speed select key: selects the speed
- start/stop key: starts and stops a real time 2 channel recording

The selected speed and sensitivity is displayed.

Terminate with any key.

3.9 V24 tests

Several possibilities are available to test the serial interface. Moreover, on the one hand, the signal transmission and receiving of the interface can be tested by an internal feedback from TXD and RXD and, on the other hand, the signal transmission and receiving with a remote station.

For the test with a remote station, the connection cable from MAC1100/1200 to PC, PN 223 362 03 is required. In addition, the following transmission protocol should be adjusted at the remote station:

1 start bit, 8 data bits, no parity
1 stop bit
Baud rate 19200

Pressing the **“6" key** calls up the following menu:

Interface test

1= Sending and receiving
2= Send test string to device
3= Send/Receive with device

A = Abort (terminate interface test)

(1) Sending and receiving
This test enables complete testing of the RS232 signal path for transmitting and receiving, including RS232 driver and connector.
This test requires an RS232 connector with an internal bridge from pin 2 (RXDE) to pin 3 (TXDE). Depending on the result of the test, the following message appears:

If test result is OK:	Out	:Hello world!
	In	:Hello world!
If an error occurs:	Out	:Hello world!
	In	: ERROR (In)

(2) Send test string to device
In this test a remote station, e.g., PC must be connected up and have a terminal program which can receive signals and be configured for the above-mentioned protocol. If the remote station is on receive, then every time the “2" key is pressed the test string “Hello world!” is transmitted to the remote station. Simultaneously, the following message appears on the display:

v24-Settings: “19200, 8, n, 1“

Out: Hello world!

(3) Send and receive with device
Sending and receiving can be tested with a remote device by pressing the “3" key. The device should be connected as described in (2).
After pressing the “3" key a test string is sent to the remote station. The following message appears on the display:

Transmitting: Hello world!

Receiving: [ ]

A subsequent input at the remote station is sent back to the device and displayed there. Moreover, it should be noted that an input must take place within 10 s and the input terminated with “return”.

3.10 Time and date

This section deals with the quick checking and setting of the time and date.
Pressing the **“7"** key calls up the following display:

Time (hh:mm) [18:25:29]

and

Date (dd.mm.yyyy) [03.03.1999]

X = End

To set time or date, select the corresponding time or date field by pressing the return key. During entering the numbers, a single cursor is not displayed.

3.11 Electrode test

The electrode test is started by pressing the **“8" key.**
The following menu is displayed:

Electrode test

Terminate with any key

Select pace electrode (key ‘P’)
Pace electrode LA

Cable = 10 electrodes (or no cable)

The status of each electrode is displayed. Electrode OK or disconnected is displayed as follows:

Status = 0 -> Electrode OK
Status = 1 -> Electrode disconnected

With the “P” key, the pace electrode can be selected. The selected pace electrode is displayed.

The status **“cable”** indicates if a cable is connected to the patient ECG input or not.

3.12 Time constant

By pressing the **"9"** key, the time constant for the ECG patient input can be selected. The following menu is displayed

1= 1.02s (frequency 0,16Hz)
2= 2.04s (frequency 0.08Hz)
3= 4.08s (frequency 0,04Hz)

X = End

The currently selected time constant appears in reverse video. Use key 1 ... 3 for selection.

The factory setting is 2.04s. This should only be changed when deemed really necessary..

3.13 Setting the device model

The setting of the device model is activated by pressing the **"D" key**, the following display image appears:

D e v I c e model

1= INT
2= USA
3= Europe 2
4= ASIA (not available from version V1.1)
5= RUSS

X= End

Warning!

Changing the device model affects the selection of the output formats and languages available, can switch the program for Interpretation from HEART to 12 SL, or vice versa. Also affected are the default configuration settings, e.g., override function yes/no, line filter 50/60 Hz.

The device model configured during manufacture should only be changed when deemed really necessary.

The following table shows the most important combinations:

Device model	Inter-pretation	Output formats	Languages	Default settings	
				Override function enabled	Line filter
01 INT	HEART	international	international	no	50 Hz
02 USA	12SL	USA	e,f,s	yes	60 Hz
03 Europe2	12SL	international	international	yes	50 Hz
04 ASIA *)	HEART	international	international	no	50 Hz
05 RUSS	HEART	international	g,e,f,r,hung, czech	no	50 Hz

- Language international: g, e, f, i, s, por, sw, nor, fin, dan, hol, czech, hung
- Europe 2: United Kingdom, Benelux, Scandinavia

*) not available from version V1.1

The required device model is selected by pressing the appropriate key, **“1"** to **“5".**

Quit selection menu by pressing the **“X“ key.**

Quit the self-test with **“X” key.**

MAC 1200 configures the appropriate items and initiates a cold start automatically. Thus, when the device is rebooted automatically all the new settings are adopted.

Selecting a particular device model leads to the configuration of the program for Interpretation as indicated in the table above, even when the interpretation program was configured differently beforehand as described in Section 3.14.

Note on saved ECGs when configuring the device model:

Saved ECGs are not lost.
If a new device model is selected, the program for Interpretation is switched over; however, when printing out the saved ECGs the display in the status line (12SL, or without in the case of HEART) is related to the currently enabled program for Interpretation, although the results are based on the program previously configured. In this case, the saved ECGs should be printed out or transferred to a PC before configuration of the new model.

3.14 Switching over the program for interpretation

Switching over the program for interpretation is activated by pressing the **“H” key**, the following display image appears:

I n t e r p r e t a t i o n

1= HEART
2= 12SL

X= End

The currently enabled interpretation program appears in reverse video.

Warning!

Switching over to another program for Interpretation affects the measurement results and the interpretation!

The program for Interpretation configured during manufacture should only be changed when deemed really necessary!

The required program for Interpretation is selected by pressing the appropriate key, **“1"** or **“2".**

Quit the selection menu by pressing the **“X” key.**

Quit the self-test with the **“X” key.**
MAC 1200 configures the appropriate items and initiates a cold start automatically. Thus, when the device is rebooted automatically all the new settings are adopted.

Note on saved ECGs when switching over the program for Interpretation:
Saved ECGs are not lost.
After switching over to a different program for Interpretation when printing the saved ECGs the display in the status line (12SL, or without in the case of HEART) is related to the newly selected interpretation program, although the results are based on the program previously configured. In this case the saved ECGs should be printed out or transferred to a PC before switching over to the new program for Interpretation.

3.15 Pace enhance

Pressing the **“P" key** calls up the following menu:

P a c e enhance

1= ON
2= OFF

X= End

The currently selected pace display mode appears in reverse video.

ON: Standard pace display mode.
Detected pace pulses are displayed as special defined pulses

OFF: Pace pulses are displayed with there own pulse form directly

The factory setting is ON. This should only be changed when deemed really necessary.

3.16 Serial number

The serial number of the device is displayed by pressing the **“N” key.**

The serial number is only displayed and cannot be changed.
The serial number is entered during the manufacturing process.

After replacing the PCB Control CS_CI, during the power up sequence, the serial number of the device has to be entered.

Terminate with the **“X” key.**

4 Repair instructions

4.1 Safety instructions

Repairs may only be conducted by approved specialist personnel.

Before opening the MAC 1200, switch off device and disconnect mains plug! Never connect mains plug when the device is open!

Before replacing the primary fuses in the power input module, the device should also be switched off and the mains plug disconnected!

For replacing components, only the original Marquette components, mentioned in the spare parts list may be used!

When replacing electronic components implement **ESD protection.**
Return replaced PCBs in **ESD packaging** only.

Defective NC batteries or empty batteries should be **disposed of in accordance with the applicable legal stipulations** or returned to the factory**.**
Batteries returned to the factory should be labeled **"For disposal"**.

4.2 Replacing components

For all the following points the safety instructions in Section 4.1. have to be observed!

Warning: The device has to be switched off!

Opening the device

To open the MAC 1200 release the 5 fastening screws on the underside of the device, open the paper feed flap, carefully raise the upper shell of the housing, disconnect keypad cable by opening the connector KEYB/ on the PCB Control.
The display remains in the lower shell of the casing.

During reassembly, ensure that no cables are pinched.

Replacing the primary fuses in the mains input module

Warning: Only use fuses indicated on the rating label! (see Section 8, Parts List)

Replacing the battery

Disconnect and lift out the battery compartment on the underside of the device by raising the middle fastening catch. Remove the battery and disconnect the battery plug BATT_IN/ from the PCB Battery Charge.

Warning: Only original Marquette batteries may be used! (see Section 8, Parts List)

Defective NC-batteries or empty batteries should be **disposed of in accordance with the applicable legal stipulations** or returned to the factory**.**
Batteries returned to the factory should be labeled **"For disposal"**.

Before putting in the new battery, insert plug BATT_IN/. Push in battery compartment, secure by pressing on the fastening catch.

Replacing the PCB Battery Charge

After opening the device, first of all open the battery compartment and disconnect the battery connector BATT_IN/ (see "Replacing the battery").
Then disconnect the connector BATT/ from the PCB Control. Undo the fastening screw next to the inductor L1 on PCB Battery Charge.
PCB Battery Charge has one soldered fuse:

SI 1: Battery fuse

No adjustments on the PCB Battery Charge are necessary.

Replacing the PCB Control

Before replacing the PCB, if still possible, printout the settings configured by the user and check the options enabled.

After opening the device first of all disconnect the plug-in connector POSUP/ to the power supply unit, and the connector BATT_IN/ from the PCB Battery Charge. Make sure that the connector BATT_IN/ makes no contact with the coated shell, while disconnected. Then disconnect the remaining connectors to the recording unit. Undo the 6 PCBs fastening screws.

Check whether the connection LOET2 of the lithium battery for the real-time clock (BA1) is correctly soldered. Also check whether the connection LOET1 of the backlight inverter is soldered correctly.
Insert new PCB, fix the fastening screws and plug in connectors.

Connect keypad in the upper shell to connector KEYB/ and close connector on PCB Control and set the upper shell on to the lower shell. Tighten the 5 fastening screws.

Load the software via RS-232 interface with the Software Download Kit part No. 2000079-001.

Enter the device serial number.

If required, enter the option codes as described in the Operator's Manual.

Adjust the display contrast.

Setting the date and time (Section 3.10).

If known, adopt the user-programmed configuration; otherwise, default setting.

If known, reset the user-programmed time constants, otherwise setting to default of 2.04s (Section 3.1.12). Check the time constant by outputting the self-test results (Section 3.1.6).

Replacing the motor

After replacing the motor, no adjustment of speed is necessary. Nevertheless run the motor test (Chapter 3.5).

Replacing the graphics display

After opening the device first of all open connector KYO/ and release the flat ribbon cable of the display. Undo the screws of both plastic display holders, shift it 2 mm in the direction to the handle and lift up display and holders. Disconnect the plug HOS_BL/.
To re-assemble do vice-versa.

Adjust the contrast with the new display.

5 Troubleshooting tips

For all the following points the safety instructions in Section 4.1. have to be observed!

Device cannot be switched on even though power plug is plugged in

- *green power lamp LED is off and device cannot be switched on:*

  - Power cable defective or not plugged in correctly?
  - Primary fuses in the mains input module defective?
  - Connector from the mains input module to the mains switching power supply plugged in correctly, or cable defective?
  - Connector from the mains switching power supply to connector POSUP/ on the PCB Control plugged in correctly, or cable defective?
  - Keypad via connector KEYB/ on PCB Control plugged in correctly?
  - 26,5V on the connector POSUP?
    → if no: - *mains switching power supply defective*
    → if yes: - *PCB Control defective*
    - *or keypad defective*

- *green power lamp LED is on, but device still cannot be switched on:*

  → - *PCB Control defective*
  - *or keypad defective*

Device cannot be switched on when being battery-operated only

- *Is the battery depleted?*

  - Plug in power plug, green power lamp LED should glow and the device can be activated,
    → if not: - *refer to "Device cannot be switched on even though power plug is plugged in".*
  - By connecting the power plug, rapid charging is activated, LED1 on the PCB Battery Charge is activated
    → if not: - *PCB Battery Charge is defective*
  - With power plug plugged in, let unit charge for 10 minutes, then disconnect power plug. Can the device be switched on and can a recording be started?
    → if yes: - *Function OK., continue loading with plugged mains plug*
    → if not: - *Battery disconnected or cable defective?*
    - *Battery defective (no capacity)?*
    - *PCB Battery Charge defective (Si1?)?*

No display on the screen

- Does the yellow Stop LED on the keypad glow after the device is switched on?
  → if not: - refer to "Device cannot be switched on ...."
  → if yes: - continue
- Does a beep sound approx. 10s after switching on the MAC1200 occur (indicates the successful power up self-test)?
  → if not: - *Self test error, PCB Control defective*
  → if yes: - continue
- Contrast badly adjusted?
- Can the background illumination be activated by pressing a key?
- Can the display test in Section 3.3 be applied successfully?
  → if not: - *graphics display module defective*
  - *or PCB Control defective*

Error in self-test identified

When an error is detected during the self-test, in addition to the message “Self-test failed”, the error code number and a short description also appear on the display. The meaning of the error codes is described in Section 3.7. The error codes refer to the PCB Control, and should be noted as information for the service center.

MAC 1200 fails to give printout, **no paper transport**

Perform the following test in the 6-lead operating mode:

- Paper available? Paper correctly inserted? Paper transport problems (jam)?
- Paper feed flap correctly engaged on both sides?
- After pressing the start key, the green start Led must glow
  → if not : - *keypad defective? Apply keypad test in Section 3.4*
  → if yes: - continue
- Paper feed flap correctly engaged on both sides?
- Mark reader defective or not plugged in?
- All connections for printhead and Motor are plugged in?
- Motor blocked ? (check roller, transmission)
- Operating only on battery which is strongly depleted?
  → if yes: - *plug in power plug*
  → if not: - *PCB Control defective*

Paper transport functions, no printout

- Paper feed flap correctly engaged on both sides?
- All connectors for printhead plugged in?
- Operation with strongly depleted battery?
  → if yes: - *plug in power plug*
  → if no: - *PCB Control defective*
  - *or printhead defective*

MAC 1200 only prints on the upper or lower section of the printout

- Paper feed flap is only engaged on one side.

MAC 1200 prints, but only baselines are printed out

- Electrodes applied correctly?
- Electrode cables plugged into the patient trunk cable terminal-box correctly?
- Patient trunk cable defective (e.g., RL defective)?
- Contact problems at the patient input connector of the MAC1200?
  → if not: PCB Control defective.

6 Adjustment instructions

For MAC 1200 no adjustment of components is required.

When PCB Control CS_CI, or the graphics display has been exchanged, the display contrast should be adjusted to an optimum contrast ratio as described in the user manual.

7 Servicing and maintenance

7.1 Technical inspection

A technical inspection is to be performed once a year. The following items, including the accessories used, are to be performed:

- Check device and accessories for mechanical defects, which impair their function.
- Perform a function check as detailed in Section 3 “System test functions”.
- Check labels and inscriptions on the device relating to safety are clearly legible.
- Measure the Protective Earth Resistance (see Section 7.1.3 /7.1.3.2).
- Measure the enclosure Leakage Current (see Section 7.1.3 /7.1.3.3.1).
- Measure the patient leakage current (see Section 7.1.3 /7.1.3.3.2).

Warning!
The following checks may only be performed by persons whose training, knowledge and practical experience enable them to carry out such checks reliably and correctly!

Notes:
The operational and functional reliability of the device is checked using the following checklists.
They serve the experienced technician when checking the device.
A knowledge of device operation as detailed in the “Operator’s Manual” is assumed.

The checklist items are based on the testing instruments given below.
The tests should be carried out using the customer’s accessories, so that defective accessories are also detected automatically.
If other testing instruments are used besides those mentioned, the items on the checklist and tolerance specifications may need to be modified.

7.1.1 Visual check

Device and accessories are to be checked to ensure that

- fuse cartridges comply with vendor’s specifications;
- labels and inscriptions on the device relating to safety are clearly legible;
- the mechanical state of the device permits its further use;
- there is no fouling which could cause any reduction in safety.

7.1.2 Test functions

7.1.2.1 Recommended testing instruments and accessories

1x Multi-parameter simulator Lionheart

1x RS232 interface connector with internal connection between pins 2 and 3 (TXD and RXD)

1x Patient trunk cable and customer electrode leads,
or 1X patient trunk cable, 10-pin 223 387 01

7.1.2.2 Test preparations

In general, the device test functions implemented in MAC 1200 are used for the tests. These are described in Section “3. Device test functions”.

Connect MAC 1200 up to the mains, the green LED for standby must glow.
Switch the device on, the self-test runs automatically, no error message should appear. When the self-test has finished the device is in the automatic mode, the yellow LED for still disabled operating mode must glow.

Modifications in the user-programmed configuration may need to be made in order to carry out the test. Should such a change need to be made to enable testing, make a printout of all the modified configuration lists and mark the changes made.

Important: After completing the test the original user-programmed configuration is to be retrieved and activated.

7.1.2.3 Operating and display unit performance tests

- Carry out the “Display test (1)” as detailed in Sections 3.3, respectively.
- Carry out the “Keypad test (2)” as detailed in Sections 3.4, respectively.

7.1.2.4 Test for recording speeds 25 and 50 mm/s

- Carry out the “Motor test ” as detailed in Sections 3.5, respectively.
- The feed speed deviations should be less than 3%.

7.1.2.5 Device Test result check

- Output “Test results ” as detailed in Sections 3.6, respectively.
  - Main parameters: - all memory stores free from error?
    - ASIC test O.K?
    - Sample rate 1000?
    - Selected time constants: 2.04 s (or 4.08 s)?
    - Printhead voltage > 18V, battery charge O.K?
    - Printout clearly legible and without any lapses or interference?

7.1.2.6 RS-232 interface test

Carry out the “Interface test ” test item “(1) Transmitting and receiving”, as detailed in Section 3.9, respectively.

7.1.2.7 Analysis of the ECG signals and HR value

Carry out the following settings on the ECG simulator:

- Amplitude 1 mV
- Heart rate (RATE) 60 bpm

Connect the electrode leads as indicated below:

R, red	(or RA)	----->	RA
L, yellow	(or LA)	----->	LA
F, green	(or LL)	----->	LL
N, black	(or RL)	----->	RL
C1, white/red	(or V1)	----->	V1
:		:	:
:		:	:
C6, white/violet	(or V6)	----->	V6

Switch in **6 lead operating mode** and start recording by pressing the Start key.

By pressing the lead scrolling key, check whether all leads **are being recorded.**
The ECG traces must be **noise-free**.

Record one page in the “6-lead” operating mode. The following annotations must be present:

- Heart rate (top right)
- Lower status line
  - date and time
  - recording speed
  - sensitivity
  - active filter, e.g., 50/60 Hz, 40/20 Hz, ADS
  - frequency range of the recording

The **heart rate** of 60 bpm +/- 2 bpm appears on the display and is printed out on the recording.

Activate the square-wave function on the ECG transmitter at 1 mV.
Using the lead scrolling key select lead II. The square-wave pulse trace must correspond in **amplitude** with the displayed 1 mV reference pulse (applicable to named transmitter only).

Switch back to ECG signal on the ECG transmitter.
Start the recording in manual mode.
Increase the **heart rate to 200 bpm** on the ECG transmitter. The acoustic **warning signal** must sound for about 1s. Reduce the heart rate back to 60 bpm, the warning signal no longer sounds.

7.1.2.8 Pacemaker identification test

Make the following settings on the multifunction simulator:
- pace setting
- pace amplitude 6 mV
- pace duration 0.2 ms

Adjust “6-lead mode” on MAC 1200 device to be tested and select lead groups I, II and III.
Start the recording. The pace pulses must be visible as needles on the recording output.

7.1.2.9 Identification of disconnected electrodes

Reset the simulator to ECG signal at a heart rate of 60 bpm. Remove one electrode after the other from the ECG transmitter.

Activate the “12 lead” mode in the MAC 1200 device to be tested without activating it by pressing the Start key.
Check to ensure that each disconnected electrode is displayed correctly and that an acoustic alarm signal sounds.

7.1.2.10 Checking the charge status of the NC battery

The NC battery can, among other things, be checked as follows:
discharging the battery, followed by charging up completely (duration 4 h), followed by discharging in standby mode without recording.
If the operating time for this procedure is under 2.5 h, the battery should be replaced.

7.1.3 Safety Analysis Tests

7.1.3.1 General information

The suggested Safety Analysis Tests refer to the international standard IEC 601-1.
The tests are generally performed with Safety Testers, on most of them, the measuring circuits according IEC 601 are already implemented.
The following is a general description of the tests to be performed. For the handling of your Safety Tester follow the user manual.

The tests may be performed under normal ambient conditions of temperature, humidity and pressure and with line voltage.
The leakage currents correspond to 110 % of rated voltage for the tested unit. Most Safety Testers take this into account, otherwise the measured values have to be calculated.

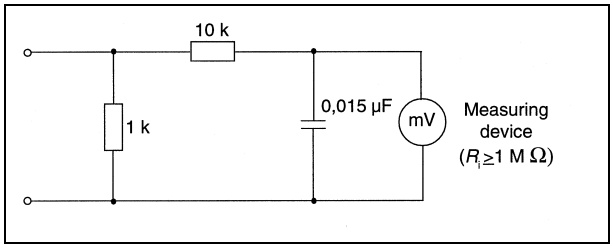
Recommended Test Equipment

- Safety Tester for measurements according to IEC 601.
- Testing connector according to the following description.

7.1.3.2 Protective Earth Resistance Test

The power cord is to be included in the protective earth resistance test.
This test determines whether the device has a power ground fault.

- The protective earth resistance from power connector to any protective earth connected exposed conductive part is measured.
- Specs. of test circuit: AC current source 50 Hz/60 Hz of at least 10 A up to 25 A with limited output voltage of 6 V.
- If resistance is greater than 100 mOhm, the unit fails this test.



7.1.3.3 Measurement of Leakage Current

To perform the suggested measurements, the unit being tested has to be separated from any interconnection to a system. If the unit is part of a system, extended tests according to IEC 601-1-1 have to be performed. The following diagram shows the
Measuring Circuit [M] required for leakage current. The reading in mV corresponds to µA (leakage current). The Safety Testers generally work with this Measuring Circuit [M] and the displayed values are already converted to leakage current.

7.1.3.3.1 Enclosure Leakage Current Test

This test is performed to measure leakage current from chassis to ground during normal condition (N.C.) and single fault conditions (S.F.C.).
In all cases, the leakage current is measured from any exposed conductive parts to ground, the unit being tested has to be switched on and off.

Connect the unit being tested to your Safety Tester.

- During normal condition (N.C.), referring to the electrical diagram, measurements have to be done under the following conditions:

* Polarity switch Norm and RVS
* GND switch GND closed
* S1 closed and open

- During single fault conditions (S.F.C.), referring to the electrical diagram, the measurements have to be done under the following conditions:

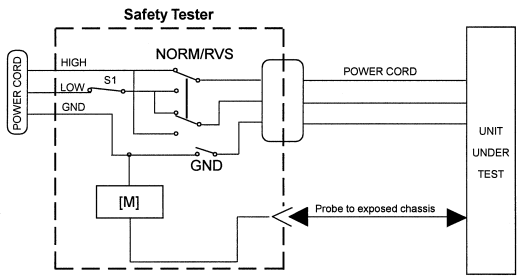
* Polarity switch NORM and RVS
* GND switch GND open
* S1 closed

Test has failed if the measured values are greater than:

N.C.	S.F.C
100 µA	500 µA
	300 µA (UL requirements)

Electrical Diagram for Enclosure Leakage Current Test

7.1.3.3.2 Patient Leakage Current Test



This test performs a leakage current test under single fault conditions (S.F.C.) depending on domestic power outlet of 115 or 230 V AC as source into the floating inputs.

In all cases, the leakage current is measured from input jack of the unit being tested to ground.

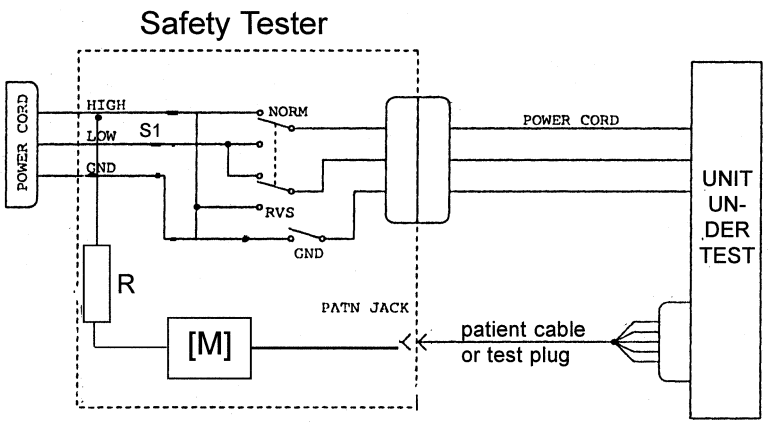
Connect the unit being tested to your Safety Tester.

■ Referring to the electrical diagram, measurements have to be done under the following conditions:

* Polarity switch NORM and RVS
* GND switch GND closed
* S1 closed

Test has failed if the measured values are greater than 50 µA.

Electrical Diagram for Patient Leakage Current Test



For the protection of the test person, the following values of resistor R may be used:

Type BF	22 kOhm (120 to 130 V)
	47 kOhm (220 to 240 V)
Type CF	100 kOhm (220 to 240 V)

7.2 Maintenance, cleaning, disinfection

MAC 1200 maintenance, cleaning, disinfection is performed in accordance with the MAC 1200 “Operator’s Manual”, Section 11, "Cleaning, disinfection and maintenance", as applicable.

Applications requiring extensive recordings may result in deposits on the thermal array printhead which normally do not, however, have any adverse effect on the printing quality. This can be removed with a soft, fluff-free cloth soaked in an alcohol-based cleaning agent (e.g., surgical spirit).

8 Parts List

Partnumber			Description		
MAC 1100					
10116801	MAC 1100	(int.)	Basic unit	with Battery	without Pump
10116802	MAC 1100	(int.)	Basic unit	with Battery	with Pump
10116807	MAC 1100	(russ.)	Basic unit	with Battery	without Pump
10116808	MAC 1100	(russ.)	Basic unit	with Battery	with Pump
10116809	MAC 1100	(europe2.)	Basic unit	with Battery	without Pump
10116810	MAC 1100	(europe2.)	Basic unit	with Battery	with Pump
10116811	MAC 1100	(int.)	Basic unit	without Battery, without Pump	
10116817	MAC 1100	(russ.)	Basic unit	without Battery, without Pump	
10116819	MAC 1100	(europe2.)	Basic unit	without Battery, without Pump	
MAC 1200					
10116821	MAC 1200	(int.)	Basic unit	with Battery	without Pump
10116822	MAC 1200	(int.)	Basic unit	with Battery	with Pump
10116823	MAC 1200	(USA.)	Basic unit	with Battery	without Pump
10116827	MAC 1200	(Russ.)	Basic unit	with Battery	without Pump
10116828	MAC 1200	(Russ.)	Basic unit	with Battery	with Pump
10116829	MAC 1200	(europe2)	Basic unit	with Battery	without Pump
10116830	MAC 1200	(europe2)	Basic unit	with Battery	with Pump

User Manual MAC 1100 / 1200

22749201	User Manual MAC 1100 / 1200	German	
22749202	User Manual MAC 1100 / 1200	English	
22749203	User Manual MAC 1100 / 1200	French	
22749204	User Manual MAC 1200	English	USA
22749205	User Manual MAC 1100 / 1200	Italian	
22749206	User Manual MAC 1100 / 1200	Spanish	
22749207	short User Manual MAC 1100 / 1200	Russian	
22749208	short User Manual MAC 1100 / 1200	Swedish	
22749209	short User Manual MAC 1100 / 1200	Portuguese	
22749210	short User Manual MAC 1100 / 1200	Norway	
22749211	short User Manual MAC 1100 / 1200	Danish	
22749212	short User Manual MAC 1100 / 1200	Finnish	
22749213	short User Manual MAC 1100 / 1200	Dutch	
22749214	short User Manual MAC 1100 / 1200	Hungarian	
22749216	short User Manual MAC 1100 / 1200	Czechoslovakian	

Service Manual

22749221	Service Manual USA. for MAC 1200
22749220	Service Manual International for MAC 1100/1200

Housing Parts

43252578	Under -case shell
92401714	Rubber foot
43252198	Battery cover
2000074-001	Upper case with keypad and filter pane (Russ.)
2000075-001	Upper case with keypad and filter pane (Int.)
2000076-001	Upper case with keypad and filter pane (USA)
2000077-001	Upper case with keypad and filter pane (Europe 2)
2000088-001	Filter pane complete with glue frame
43252554	Sign Marquette Hellige
43252555	Sign Marquette
30344319	Handle
41611818	Leaf Spring
92916645	Luer- connection (female)
92916648	Luer Nut
92916654	Luer-cap
43252566	Filler Panel
43252567	Connector Pan

Recorder Parts

2000078-001	Drive Flap complete with Gearwheels and Roller
48015967	Gearwheel assembled on Roller
48015969	Gearwheel assembled on Motor
48015966	Gearwheel big, assembled between Roller and Motor
30344746	Motor
43252213	Cover plate for Motor
30343829	Code reader
30344271	Thermal Printhead
38802910	PCB Printhead connection
43252209	Plastic holder for Printhead left side
43252210	Plastic holder for Printhead right side
41515439	Pressure spring for Printhead
50465725	Metal Tube
50465774	Contact Plate
50465726	Press Strip

Keypads

39000200	Keypad International
39000201	Keypad Europe2
39000202	Keypad USA
39000203	Keypad Russ.

Electronic components / PCBs

91541936	Line filter with fuse holder
30344270	Battery
38803290	PCB Battery charging
93011858	PCB. Power Supply
2000070-002	Spare PCB. Control with remote start for MAC 1100
2000071-002	Exchange PCB. Control with remote start for MAC 1100
2000072-002	Spare PCB. Control with remote start for MAC 1200
2000073-002	Exchange PCB. Control with remote start for MAC 1200
2000771-001	PCB Modem Supply CS_M (US only)
91208449	Fuse T 1,25 A
92916717	Battery 3 V 0.255 Ah
30344291	Pump 12 V (Standard)
38803125	PCB. Pump

Display-Module Graphics

93011717	LCD-Modul Graphic
43252565	LCD Holder right side
43252564	LCD Holder left side

Wire Set

38327399	Wire set for MAC 1100/1200

Connection cable (for MAC 1100/ 1200)

22336203	Connection cable from MAC 1100/1200 to CardioSys/Soft
22337801	Connection cable from MAC 1100/1200 to Modem 9- pin connector
22337802	Connection cable from MAC 1100/1200 to Modem 25- pin connector
22337804	Connection cable from MAC 1200 to Modem 25 with supply (US only)
22333004	Connection cable from MAC 1100/1200 to M(L) 700
22336203	Connection cable from MAC 1100/1200 to ECB560/561
22336604	Connection cable from MAC 1100/1200 to EC1200

Service Tool

2000079-001	Software download kit, including connection cable to PC.

Release Software Package

2000284-004	Software Package for MAC 1100 Version V5.1
2000285-004	Software Package for MAC 1200 Version V5.1

9 Specifications

Recording

Direct recording of waveforms and alphanumeric characters with rectangular coordinates by means of thermal-array printhead printing on thermosensitive paper.

- 3 or 6 recording channels, or 12 in 12 Lead Mode, overlapping
- baseline pitch 3 channels: 62 mm (arrhythmia) 6 channels: 31 mm (6 Lead)
  12 channels: 16 mm (12 Lead.)
- writing width 200 mm max.
- annotation of recorder settings, date, time and entered patient name in the margin of the recording strip
- with appropriate software, documentation of analysis results in the respective operating mode
- resolution of the recording:
  vertical 8 dots/mm
  horizontal 25 µm at 25 mm/s

Printer paper

Marquette CONTRAST Z-fold pad , 150 pages per pad, equivalent to a chart length of approx. 45 m

paper width: 8.5 inch

sheet length: 11 inch

To prevent damage to the printhead use only the original Marquette CONTRAST paper or the Marquette thermal paper with queue holes or marks.

Paper transport

- paper speed
  5-25-50 mm/s, key selectable
  error limits at 25 and 50 mm/s, typ. ±l%
  at 5 mm/s, ±10% max.
- At paper end, the recorder emits an audio signal and stops recording
  the last pages of the pad bear a colored stripe in the lower margin

Membrane keypad

Pushbuttons with tactile feedback

- function keys for all routine operations
- alphanumeric keyboard for entry of text

Display

graphics display with 24 x 40 characters, contrast adjustment

resolution of 320 x 240 pixels with display backlighting

Indicators (LED's)

For mains power, battery status and start/stop function

Automatic functions

They assist and facilitate operation by

- automatic control of lead selection, paper feed, calibration (configurable)
- report formatting (configurable)
- automatic baseline adjustment
- anti-drift system (cubic spline) compensating for polarization voltage fluctuations (configurable)

Detection of pacer pulses

- pulse length between 0.1 and 2.5 ms
- pacer pulse marker independent of pulse polarity
- pulse amplitude between ± 5 mV and ± 700 mV

Heart rate indication

derivation of the heart rate from all ECG signals

- display range between 30 and 300 bpm
- display update with every heart beat, maximum every 2 seconds

Signal inputs

isolated patient signal input, IEC type CF, high-voltage protection for all lead connections and neutral electrode, interference compensation via neutral electrode, monitoring for open leads

- electrode connections for RA, LA, LL, LA, Vl to V6
- input impedance for differential signals between any two electrode connections > 10 MΩ at 10 Hz
- input impedance for common-mode signals referred to neutral electrode > 50 MΩ up to 60 Hz
- dynamic range for differential signals between any two electrode connections for AC voltage ±10 mV, for superimposed DC voltage (polarization voltage) ±600 mV
- dynamic range for common-mode signals referred to neutral electrode ±l V, referred to chassis 263 V AC (rms.)
- quiescent input current via any electrode connection for l kΩ termination referred to neutral electrode < 50 nA
- patient leakage current (rms values) according to IEC, class CF: in normal condition < 10 µA, in single-fault condition (e.g. patient in contact with line voltage) < 20 µA
- non-destructive range for lead-electrode connections and the neutral electrode connection referred to neutral electrode ±50 V, referred to chassis ±1500 V
- pulse voltage resistance of all lead electrode connections and of the neutral electrode connection referred to chassis (either polarity, e.g. defibrillation) 5000 V
- monitoring of each electrode for open leads: RA, LA, LL, RL, Vl, V2, V3, V4, V5, V6 audio signal at printer start

Data interface

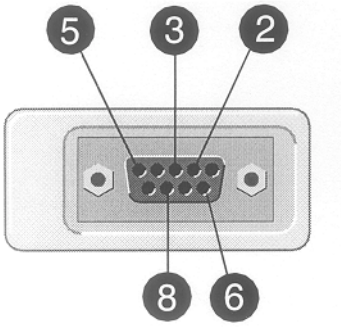
one serial RS232 interface for exchange of data with suitable external devices and software handshake

RS232 interface (standard V.24 interface):

- input voltage range. ± 15V max.
- output voltage range ±5 V min.

interface protected from electrostatic discharge for ±10 kV max.

Pin assignment of data port



2 RXDE

3 TXDE

5 circuit reference

6 Modem Supply (MAC1200 US only)

8 Remote Start Input

Remote Start (hardware)

Paper feed via remote control connection (depending on selected operating mode). External make contact referred to chassis via circuit reference:

- source impedance Ri < 300 Ω
- contact dwell > 100 ms
- non-destructive load ±10V
- ESD interface protection up to ± 10kV

Signal Transmission

Patient input to recording

After lead formation and digitization, simultaneous transmission of all electrode signals to the digital processing system; muscle filter, AC filter, pacing pulse identification, automatic or manual sensitivity adjustment, automatic baseline adjustment and drift compensation by means of the anti-drift system (A.D.S.) can be enabled or disabled simultaneously for all channels; digital output of processed signals via thermal-array printhead.

- low cut-off frequency (-3 db limits) 0.08 Hz, equivalent to a time constant of 2.04 s
- high cut-off frequency (3 dB limits) operating mode: 12 Lead, 6 Lead 150 Hz (IEC/AHA) operating mode: Arrhy 100 Hz (IEC)
- signal sampling rate: 1000/s
- resolution, referred to the input 5 µV
- output rate to recorder 2000/s
- for all leads, gain adjustment in four steps:
  40-20-10-5 mm/mV

- with active muscle filter (low-pass characteristic) 3-dB drop of the amplitude frequency response at approx. 40 or 20 Hz
- with active AC line filter detection and compensation of periodic 50 or 60 Hz frequency components (depending on recorder model) attenuation >40 dB
- non-linear distortion below values specified in IEC and AHA recommendations
- coincidence error limits between any two channels ±0.5 mm
- detection of pacer pulses in V2 or other V leads and marking in all channels for signals referred to patient input:
  duration ≥ 0.1 ms, amplitude > 5 mV
- noise in the signal transmission path below values specified in IEC and AHA requirements: ≤ 2.5 µV rms
- common-mode rejection for 50 or 60-Hz signals (depending on recorder model) with AC filter switched on >140 dB

ECG calibration

automatic recording of a defined voltage step, valid for all channels

- calibration voltage, referred to ECG signal input: l mV
  calibration pulse width on recording depends on paper speed
  25 mm/s: 5 mm
  50 mm/s: 10 mm
  5 mm/s: 1 mm

Automatic ECG gain adjustment

The gain automatically adapts to the incoming signal. The maximum amplitude of the lead group or of all leads determines the gain setting.

- automatic adjustment range 5 to 40 mm/mV
- amplitude range (6 channels) 18 to 31 mm

Baseline

automatic adjustment of the baseline to the optimal recording range, in dependence of the signal amplitude

Anti-drift system (ADS) (cubic spline)

automatic compensation of baseline fluctuations caused by polarization voltage fluctuations at the lead electrodes (delay in recording: 4.2 s)

ECG storage

in 12 Lead Mode, storage of up to 40 ECGs

- stored ECGs can be deleted (individually or all in one pass), printed, transferred, and patient data can be edited
- when memory is full user is informed of the possible actions

Blocking

rapid charge reversal of the coupling capacitors in the preamplifiers after electrode application ensures that the baseline is quickly restored to its original position after overranging

Electrode monitoring

audible and visual indication on the LCD of disconnected electrodes or line break; each single electrode is monitored

Text input

patient and user data as well as comments can be entered via the panel keyboard and are annotated on the recording strip

Copy function

after ECG recording in 12 Lead Mode, copies of the ECG can be printed from memory and/or transferred to a MUSE CV system (configurable)

Test

automatic performance test upon power up, including verification of the signal path starting at the signal input

stored test ECG data for demonstration of the device functions

Power supply

from the power line or from a built-in rechargeable battery, automatic switchover; automatic battery charging during line-power operation from integrated AC adapter module

Mains operation

- instrument design in protection class I according to IEC 601-1
- **Rated voltage range** **95 to 240 V**
- operating voltage range 85 to 264 V, 49 to 65 Hz
- rated current: 0.2 ... 0.6 A
- fuse 2 x T 1.25A, 5x 20
- typical power consumption battery charging 14 W
- max. power consumption 29 W

Battery operation

- type: nickel-cadmium
- rated battery voltage 18 V
- rated battery capacity 1.3 Ah
- fully charged battery sufficient for up to 50 12 Lead Mode, 1-page ECGs, if unit is only switched on to record the ECGs
- battery charge time approx. 4 hours
  (min. charge time for one 12 Lead Mode ECG: 10 minutes)
- battery life approx. 2 to 3 years, replacement by service only
- lithium battery for built-in clock, battery life approx. 5 years, replacement by service only

Operational readiness

After successful self-test, approx. 10 s after power-up

Operating position

horizontal

Environment

Operation

- temperature between +10 and +40 °C / 50 and 104 °F
- relative humidity between 25 and 95%
- atmospheric pressure between 700 and 1060 hPa

Transport and storage

- temperature between -30 and +60°C / -22 and +140 °F (including battery)
- relative humidity between 25 and 95%
- atmospheric pressure between 500 and 1060 hPa

Recorder dimensions

- width 370 mm / 14.5 in.
- height 95 mm / 3.7 in.
- depth 320 mm / 12.6 in. (incl. handle)

Weight

- approx. 5.6 kg / 12.3 lb (with battery)

10 Device Documents

The following documents are enclosed:

Assembly drawing:	101 168 01 … 30
Entire Instrument wiring specification	101 168 01 … 30 S, sheet 1
Master Record Index, Version V1.1	101 168 01 ... 30
PCB Control CS_CI	388 032 67 P, sheet 1/10 ... 10/10 388 032 67 R, sheet 1
PCB Control CS_C	388 032 68 R, sheet 1
PCB Battery Charge CS_CI	388 032 90 P, sheet 1 388 032 90 R, sheet 1
PCB Modem Supply CS_M	2000772-001, sheet 1 (P-Plan) 2000771-002, sheet 1 (R-Plan)

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423 203 59

504 660 53
M3x6 DIN7985
(801 776 31)

432 522 13
3x10 Plastite 45 Senk
(801 777 00)

Sich.Ring 6x0,7 DIN471 (2x)
(804 177 24)

432 522 29
in 01,02,05...11,15,17,19,21,22,25...30
3x14 Plastite45 Senk
(801 777 17)

432 522 09
3x12 Plastite 45 (2x)
(801 777 08)

432 522 34
3x10 Plastite 45 Senk
(801 777 00)

432 522 12
in 01,02,05...11,15,17,19,21,22,25...30
2,2x8 Plastite Linsenk. (2x)
(801 777 14)

432 526 11

303 438 29
in 23

504 657 74
M3x6 DIN7985 (2x)
(801 776 31)

388 029 10

927 230 26
auf Unterseite geklebt
glued on underside

915 414 86 6-pol. auf Lpl.
915 414 82 6-pin on pcb
915 416 21 6-pol. auf Kamm
6-pin on printhead

416 118 19 2x

925 096 31 2x

416 118 18

504 657 25

M3x6 DIN7985 (801776 31)
B3 DIN127 (804 177 18)
unter Schraubenkopf
under screw head
A3,2 DIN6798 (804 082 00)
zwischen Kabelschuh und Druckbalken
between cable lug and press bar

432 522 10
3x12 Plastite 45 (2x)
(801 777 08)

923 081 00 2x

430 036 00

432 525 71
3x12 Plastite 45
(801 777 08)

930 117 17
2,2x8 Plastite 45 (4x)
(801 777 14)
2,2 Din 125 (4x)
(804 022 00)

388 032 90
M3x6 DIN7985
(801 776 31)
in 01,02,05...10,21...23,25...30

927 228 94 16
in 23

432 525 65
M3x8 DIN7985
(801 776 40)

504 657 24
in 01,02,05...11,15,17,19,21,22,25...30

2000771-001 b
in 23
M3x6 DIN7985 (2x)
(801 776 31)

M 2:1

A4,3 DIN6798
(804 083 00)

M4x10 DIN7985
(801 776 35)

B4 DIN127
(804 125 00)

916 118 00

432 525 66

Sicherung
Fuse/Plastite
S11 TIRS T4A

an beiden Enden montiert
clipped to both ends

432 525 53

432 525 67

432 525 64
M3x8 DIN7985
(801 776 40)

416 118 49

419 118 48

416 118 22

421 032 54 2x

432 521 92 2x

927 229 55
in Batteriefach geklebt
glued into battery compartment

Beschriftung siehe Besch.Blatt
nach Variante
15
16

in 02,06,08,10,22,26,28,30

303 442 91

923 096 84

388 031 25

383 273 27

923 096 65

927 228 48
M3x6 DIN7985 (3x)
(801 776 31)

388 032 67 in 21...23,25...30
388 032 68 in 01,02,05...11,15,17,19
M3x6 DIN7985 (6x)
(801 776 31)

432 521 91
Zyl.Shift ISO 2338-B-4x24 (2x)
(805 124 16)

Gehäuseoberteil

432 525 55 marquette

423 203 58

432 525 69
geklebt
glued

419 070 87
mit
927 230 27 170 lg abgedeckt

430 514 59 13
in Gehäusemitte aufgeklebt
in 23

929 166 45
929 166 48
929 166 54
in 02,06,08,10,22,26,28,30

Gehäuseoberschale
Bohrung ausgestanzt

432 525 59 (MAC 1100), in 01,02,05...11,15,17,19
432 525 60 (MAC 1200), in 21...23/25...30

390 002 00 inter1, in 01/02/11/21/22
390 002 01 inter2, in 05/06/09/10/15/19/25/26/29/30
390 002 02 USA, in 23
390 002 03 russ, in 07/08/17/27/28

432 521 99

303 442 72

303 438 29

303 442 71

432 522 11
geklebt
glued

432 525 78
M4x40 DIN7985 mit Schaft (4x)
(801 776 86)
M4x20 DIN7985
(801 776 36)

415 154 39 4x
symetrisch montiert

504 657 26
M3x8 DIN965 (2x)
(841 550 42)

504 657 60
in 23

432 521 98

423 203 27
BZ 2,2x4,5 DIN7981
(801 776 73)

829 074 08 2x 70mm
ca. 130mm Abstand, mittig
in Batteriefach geklebt
glued into battery compartment

303 442 70
in 01,02,05...10,21...23,25...30

504 660 52
3x12 Plastite 45 (5x)
(801 777 08)

Gehäuseoberteil, Ansicht von innen
M 1:2

927 230 38

480 159 69
Greifring G2 x 0,6 (804 107 00)
lock ring

Haube 432 522 13 abgenommen
hood 432 522 13 removed

927 230 20
siehe Beschilderungsblatt
see labels catalog
01 02 03 04

927 230 20 14
in 23

430 518 20 12
in 23

924 017 14 4x

432 525 72

b 303 447 46
Motor von innen montiert
motor mounted from rear
2,5x10 Plastite 45 (2x)
(801 777 27)

925 096 36

925 093 00

480 159 66
Greifring G2 x 0,6 (804 107 00)
lock ring

BH für alle Zahnräder
for all gear wheels

480 159 67

CAUTION:
US Federal law restricts this device to sale by
or on the order of a physician

423 203 60

930 118 58
2,5x8 Plastite 45 Flachrundkopf (4x)
(801 777 20)

430 501 00 11
in 23

Sicherungen / fuses:
912 084 49 (2x) T 1,25 A

Hierzu: Drahtsatz 383 273 99
also see: wire set 383 274 09 in 101 168 02,06,08,10,22,26,28,30
b 2001795-001 in 101 168 23

Marquette Hellige GmbH Muenger Str. 3 D-79111 Freiburg							
Werkstoff - Material							
Rohteil	b	3x	064/150	Sach-Nr. und Text hinzu, Sach-Nr. berichtigt		30.11.99	Deimel
	a	---	---	neu		02.11.99	Deimel
	Ersatzteil Teilnr. ref. Part No.		ECO No.	Änderungsbeschreibung - Change Description		Datum - Date	Name
Freiheitsmaß - Tolerance	Projektion		Format	Maßstab - Scale	Oberfläche - Finish	Gezeichn - Date	Name
			A0	1:1		Schaefer-Drawn	06.12.98
File Name 10116801-D01_ZM01						Gepr/Approved	02.11.99
Dokument Bezeichnung - Document Description doc mech dwg ZM01	Dacho.Art/Blatt Nr.		Teil Bezeichnung - Part Description			Gepr/Approved	
Dokument Nr - Document No. 10116801-D01	ZM/01		MAC1100 / MAC 1200			Teil Nr - Part Number	101 168 01

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Gerätestecker
Power Plug
915 419 36

Sicherungen
Fuses and ratings
2 x T 1,25 A 912 084 49

Netzteil
Power Supply
930 118 58

Display 930 117 17

ⓒ PCB Modem Supply CS_M
2000771-001
in 101 168 23

Chassis
504 660 52

303 442 71
930 116 87

Druckbalken
Press Strip
504 657 26

Thermokamm 216 mm
Thermal Array Printhead 216mm

Lpl Kammverbindung
PCB Printhead Connection
388 029 10

Markenleser 303 438 29
Mark Reader
in 101 168 23

Markenleser 303 438 29
Mark Reader
ⓑ

Motor
303 447 76

Motor
303 447 46

MOTOR/
388 032 67 / 68

Lpl Pumpenhalter
PCB Pump Holder
388 031 25
in 101 168 02,06,08,10,22,26,28,30

Pumpenmodul
Pump Modul
303 442 91

383 274 09
in 101 168 02,06,08,10,22,26,28,30

Lpl Steuerung CI
PCB Control CI
388 032 67
in 101 168 21...23,25...30

Lpl Steuerung C
PCB Control C
388 032 68
in 101 168 01,02,05...11,15,17,19

Lpl Akku-Ladung
PCB Battery Load
388 032 90
in 101 168 01,02,05...10,21...23,26...30

Batterie
Battery
303 442 70
in 101 168 01,02,05...10
101 168 21...23,26...30

Akku 18V 1,4Ah
929 166 37

Tastatur
Keyboard
390 002 00 in 101 168 01, 02, 11, 21, 22
390 002 01 in 101 168 05, 06, 09, 10, 15, 19, 25, 26, 29, 30
390 002 02 in 101 168 23
390 002 03 in 101 168 07, 08, 17, 27, 28

Hierzu / also see:
Drahtsatz / wire set:
383 273 99
383 274 09 in 101 168 02,06,08,10,22,26,28,30
ⓒ 2001795-001 in 101 168 23

Marquette Hellige GmbH, Munzinger Str. 3, D-79111 Freiburg					
Werkstoff - Material					
	c	2x	064150	Lpl und Text hinzu	30.11.99 Deimel
Rohteil	b	1x	061952	Text entfallen	12.04.99 Deimel
Entw.: N.Schnurr	a		neu		08.03.99 Deimel
Änd.Index Revision	Anzahl vor Nummern	ECO No.	Änderungsbeschreibung - Change Description		Datum - Date / Name
Freimaßtoleranz - Tolerance	Projektion	Format A1	Maßstab - Scale 1:1	Oberfläche - Finish	Datum - Date / Name
					Entwerfen-Drawn 07.12.98 Deimel
					Geprüft-Approved 17.12.98 N.Schnurr
					Geprüft-Approved
File Name 10116801-D03_SZ					
Dokument Bezeichnung - Document Description doc schem SZ01	Zeichn.Art/Blatt Nr. SZ/01	Teil Bezeichnung - Part Description MAC 1100/1200			Teil Nr. - Part Number 101 168 01...30
Document Nr. - Document No. 10116801-D03					

Diese Tabelle definiert die gültigen Konfigurationen des MAC 1100/1200 Version 1.1
This table defines the valid configurations of the MAC 1100/1200 Version V1.1

Komponente / Component			Sach-Nr. / Part No.	Index (Prod.)	Referenz / Reference	kompatibel(Service) / Compatible(Service)	in Variante / in Device Variation
Steuerung CS_C	Lpl Steuerung CS_C	PCB Control CS_C	388 032 68	E		B,C,D	01,02,07...11 17,19
	Ersatzteil-Nr.	Spare Part No.	2000070-002				
	Austausch Nr.	Replacement No.	2000071-002				
Steuerung CS_CI	Lpl Steuerung CS_CI	PCB Control CS_CI	388 032 67	F		C,D,E	21...23 27...30
	Ersatzteil-Nr.	Spare Part No.	2000072-002				
	Austausch Nr.	Replacement No.	2000073-002				
Akku-Ladung CS_CI	Lpl Akkuladung CS_CI	PCB Battery Charge CS_CI	388 032 90	D		B,C	01,02,07...10 21...23,27...30
	Ersatzteil-Nr.	Spare Part No.	-				
	Austausch Nr.	Replacement No.	-				
Netzteil Power Supply	Lpl SNP-9549-MH	PCB SNP-9549-MH	930 118 58	A			01,02,07...11 17,19 21...23,27...30
Remarks Index A :	Skynet Netzteil SNP-9549-MH						
Modem Supply	Lpl Modem Supply CS_M	PCB Modem Supply CS_M	2000771-001	A			nur in/only in 23
	Ersatzteil-Nr.	Spare Part No.	-				
	Austausch Nr.	Replacement No.	-				
Pumpenmodul:			303 442 91	A			
	Lpl Pumpe	PCB Pumpe	388 029 18	B			02,08,10, 22,28,30
	Ersatzteil-Nr.	Spare Part No.	-				
	Austausch Nr.	Replacement No.	-				
	MAC 1100 V1.1						01,02,07...11,17,19
	MAC 1200 V1.1						21...23,27...30
Software MAC 1100							
	Software Code SW_MAC 1100 V5.1		2000252-004				01,02,07...11 17,19
	Ersatzteil-Nr.	Spare Part No.	2000284-004				
	Austausch Nr.	Replacement No.	-				
Software MAC 1200							
	Software Code SW_MAC 1200 V5.1		2000253-004				21...23,27...30
	Ersatzteil-Nr.	Spare Part No.	2000285-004				
	Austausch Nr.	Replacement No.	-				

Marquette Hellige GmbH
Munzinger Str. 3
D-79111 Freiburg

Werkstoff - Material

Rohteil

Freimaßtoleranz - Tolerance

File Name: 10116801-D04__SZ02

Dokument Bezeichnung - Document Description: doc schem SZ02

Dokument Nr. - Document No.: 10116801-D04

Änd.Index Revision	kommt vor numbers	ECO No.	Änderungsbeschreibung - Change Description	Datum - Date	Name
g	-	064150	MAC1100/1200 V1.1	11.01.00	G.Kaltenbach
f	-	063901	Schutzschaltung V9	13.12.99	G.Kaltenbach
e	-	062727	Software Release V5.02	08.07.99	G.Kaltenbach
d	-	062289	Bauteilezusammenfassung Lpl Steuerung	21.05.99	G.Kaltenbach
c	-	062136	Software Release V5.01	10.05.99	G.Kaltenbach
b	-	061952	Text in Feldern "Software MAC1100 und 1200" geändert	18.03.99	Deimel
a		neu		08.03.99	G.Kaltenbach

Projektion | Format: A4 | Maßstab - Scale: 1:1 | Oberfläche - Finish

	Datum - Date	Name
Entworfen-Drawn	08.03.99	G.Kaltenbach
Geprüft-Approved	08.03.99	N.Schnurr
Geprüft-Approved		

Zeichn.Art/Blatt Nr.: SZ/02

Teil Bezeichnung - Part Description: Master Record Index MAC 1100/1200 Version1.1

Teil Nr. - Part Number: 101 168 01..30

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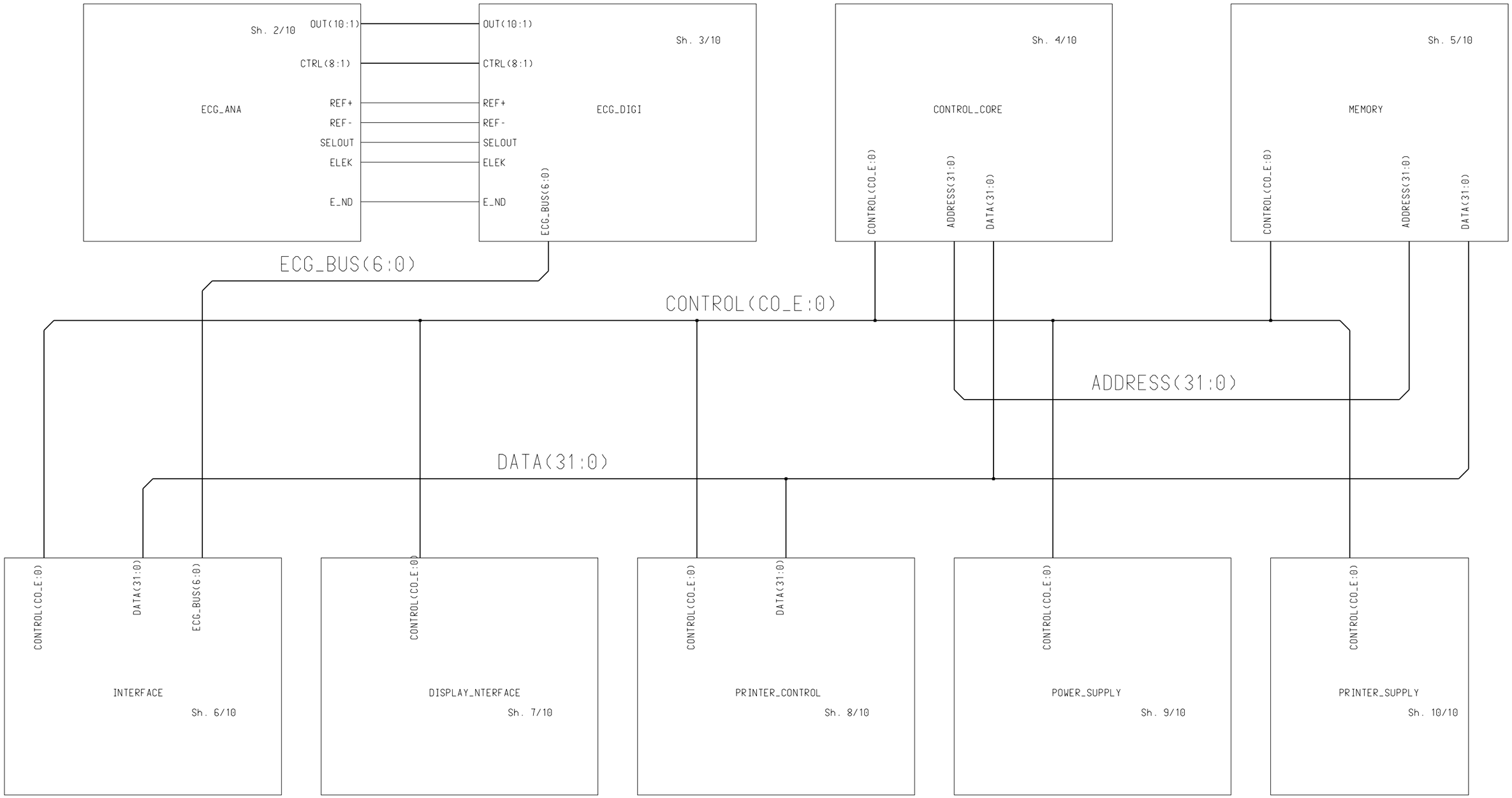
Schutzvermerk nach DIN 34 beachten



Schutzvermerk nach DIN 34 beachten

Marquette Hellige GmbH D-79007 Freiburg						388 032 67 -D01 Sheet: 1 of 10
Not equipped in Version :		REVISIONS Revision-No	Index	Date / Name	A03	F67252
x1	388 032 67	------	A	25.09.98/NTS		Date / Name
x2	388 032 68	ECO-062920	B	13.01.00/NTS	DRAWN	12.02.98 / NTS
x3					APPROVED	09.03.98/NTS
x4						
x5					ISSUED	N. SCHNURR
SCHEMATIC STEUERUNG CS_CI						

[1997, 8, 11, 2]
$USER_CAE_B/cardiosmart_ci/design

integrated CKT BD Capacitor

CX1 27P x1 x2

EKG/10 L
EKG/11 F
EKG/12 C1
EKG/1 C2
EKG/2 C3
EKG/3 C4
EKG/4 C5
EKG/5 C6
EKG/15 Nax
EKG/13 Nst
EKG/9 R
EKG/14 N
EKG/6
EKG/7
EKG/8

MMBD1503A D44 D46 D48 D41 D43 D45 D47 D49 D56 D50 D42 D53

47K5 R363 R383 R396 R373 R406 R421 R415 R428 R459 R440 R434 R450

120M R372 R395 R405 R382 R414 R427 R420 R433 R458 R449 R439

100p C172 24K3 R390

TLC2264CD V17 V18 V20 V16

AVSS AGND AVDD

100n C173 C176 C291 C177 C292 C293 C182 C171 C298 C195 C194 C199 C294 C208 C299 C226 C225 C229 C296 C191 C300 C221 C297 C222 C301 C164 C162 C234 C235 C228

68K1 R404 R447 R438 R432 R388 R391 R478 R463 R524 R531 R575 R574 R448 R464 R548 R541 R511 R515 R532 R544 R582 R609 R599 R573 R510

24K3 R431 R438 R388 R478 R524 R575 R448 R548 R515 R535 R546 R582 R609

100p C208 C229 C182 C177 C171 C194 C200 C213 C217 C219 C236 C238 C222 C221 C191

1n C166 C168 C169 C179 C183 R364 R377 R387 R435 R443

150K R409 R424 R473 R474 R471 R472 R341 R342 R556 R566 R630 R631 R628 R629 R505 R507

150p C174 C178 C189 C190 C187 C188 C157 C158 C224 C232 C267 C268 C265 C266 C203 C204

100K R344 R343 R508 R509 R641 R345 R324 R338 R313 R378 R359 R365

100n C156 C170 C261 C202 C220 C201

SDM_HEC2 Z28 Z33

IM1A IM2A OUT2A REFA OUT1A IM1B IM2B OUT2B REFB OUT1B IM1C IM2C OUT2C REFC OUT1C IM1D IM2D OUT2D REFD OUT1D IM1E IM2E OUT2E REFE OUT1E

AVSS AVDD DVDD DVDD1 DVSS SWITCH OUT1 OUT2 OUT3 OUT5 OUT4 RMPP RMPM CLK PDN REFM2 REF1M REFP2 REF1P

470P C186 C264 33K2 R470 R626 18K2 R505 R627 BAS32 D55 D72 BAS32 D54 D71

CD4051B MUXDMUX Z35

Vcc=AVDD, Ground=AGND, Vee=AVSS

BZV55C5V6 D87 D88

4u7 L73 L72 L83 L82 L75 L76 L77 L78 L79 L81

0R R647 x1, x2 10K R641 47K5 R799 10P C303 24K3 R540 249K R599 R573 0U22 C234 C235 3n3 C228 47K5 R547 BAS85 D68

OUT(10:1) REF+ REF- CTRL(8:1) SELOUT ELEK E_ND

ECG_ANA

Schutzvermerk nach DIN 34 beachten

Marquette Hellige GmbH D-79007 Freiburg						388 032 67-D02	Sheet: 2 of 10
Not equipped in Version :	REVISIONS				A03	F67252	
	Revision-No	Index	Date / Name			Date / Name	
x1	388 032 67	---	A	04.02.99/HTW			
x2	388 032 68	ECO-062920	B	13.01.00/NTS	DRAWN	12.01.99/HTW	SCHEMATIC
x3					APPROVED	09.03.98/NTS	STEUERUNG CS_CI
x4							
x5					ISSUED	H. WEBER	

[1997, 8, 11, 2]
$USER_CAE_B/cardiosmart_ci/control_ci/design/ecg_ana

OUT(10:1)

CTRL(8:1)

ELEK

SELOUT

REF+

REF-

E_ND

ECG_BUS(6:0)

DIGI_HEC2

CIN1 CIN2 CIN3 CIN5 CIN4 CIN6 CIN7 CIN8 CIN10 CIN9 SWITCH OP1 OP2 OP3 OP4 PL1 PL2 PL3 INP1 INP2 INP3 INP4 RESP

SCLK MOSI KARDMON EXTVEN RESETIN NCSO* MISO OSCIN OSCOUT CLKIN DVSS DVDD TSYNC PACE2 PACE1 PDNOUT CLKOUT RESOUT

Z22

4.096MHz G165 QU2 22p C181 22p C167

100n C227 100n C163

4K75 R659 DVDD

R389 30R1

HCPL2630 X10 X9 X11

+5VF 100n C138 100n C137

R222 475R SPICKL_

R221 475R SPIMOSI_

R220 475R HEC_RESET

R219 475R HEC_CS0

R244 475R R243 475R

L84 1u6 L85 1u6 HEC_MISO_ TSYNC_

R242 1K R241 1K R240 1K R239 1K

C124 100n R224 1K R223 1K

C117 100p C123 x1,x2 100p C122 x1,x2 100p C121 x1,x2 100p C120 x1,x2 100p C114 x1,x2 100p C125 x1,x2

L66 0u1 +5V

PIC Pace-HEC_CI Z21

VDD VSS RB0 RB1 RB2 RB3 RB4 RB5 RB6 RB7 MCLRN OSC1 OSC2 RA0 RA1 RA2 RA3 RA4

R311 10K R292 10K R288 10K

R248 10K R246 10K R247 10K R255 10K

R538 18K2 R479 150K R468 4K75 AVDD

R498 49K9 LM339D V19 R455 4K75

R493 10K R492 47K5 R529 24k3 R514 16K2 R456 4K75 R446 4K75

BAS85 D52 BAS85 D51

R571 30K1 R570 0R R567 30K1 R577 1K 1n5 C233 LMC6484IM V22 0U22 C240 R617 30K1 R633 21K5 R632 4K32

REF+ R622 100R 1U C239 AGND LMC6484IM 15n C241 V22

BAS32 D59 10K R551 AVDD R611 10K R552 1K87

15n C231 R579 10K R550 19K6 TL431ACD [SHUNTREG] +[2,5V] 0V V21

100n C270 0U47 C214 0U47 C215 R601 10K R578 100R 100n C230 LMC6484IM V22 1U C223 AGND

TL750L05CD VREG V15 V14 5V GND V+

BZV55C5V6 D90 BZV55C5V6 D89 x1,x2 47U C146 47U C145 100n C140 100n C141 220U C153 220U C151 100n C148 100n C147 100p C150 100p C139 1K R272 1K R250 BAS85 D37 BAS85 D36

DVSS AGND DVDD AVDD AVSS -5VF

74HCT14 Z12

W1 S1 S2 W3 W2 Tr1

100n C118 100n C116 68M R238 R218 2K21 100p C119 BAS85 D34

T24 IRLR024 R226 332R

470U C112 10u L64 +5V

74HCT14 Z12 74HCT14 Z12 74HCT14 Z12

C113 470p 100K R205 BAS85 D35 10u L63 GND

F125KHZ

475K R803 100n C302 AGND LM339D V19 4K75 R349 AVDD

R801 22K1 R453 10M R457 4K75 BAS85 D38 47K5 R800 AVDD

AVSS 22K1 R802 10M R491 R467 4K75 BAS85 D39

100n C207 AGND R496 475K LM339D V19 R477 4K75

ECG_DIGI

Schutzvermerk nach DIN 34 beachten

Marquette Hellige GmbH D-79007 Freiburg						388 032 67-D03	Sheet: 3 of 10
Not equipped in Version :		REVISIONS Revision-No	Index	Date / Name	A03	F67252	
x1	388 032 67	------	A	17.09.98/NTS		Date / Name	SCHEMATIC
x2	388 032 68	------	B	04.02.99/NTS	DRAWN	12.01.99/HTW	
x3		ECO 062920	C	13.01.00/NTS	APPROVED	09.03.98/NTS	STEUERUNG CS_CI
x4							
x5					ISSUED	H. WEBER	

[1997, 8, 11, 2]
$USER_CAE_B/cardiosmart_ci/control_ci/design/ecg_digi

MPC821

Z24

Vcc=+3.3V

Clock Generator

Reset Configuration

WatchDog

CONTROL CORE

Schutzvermerk nach DIN 34 beachten

Marquette Hellige GmbH D-79007 Freiburg	388 032 67-D04
	Sheet: 4 of 10
SCHEMATIC	
STEUERUNG CS_CI	

Not equipped in Version :	Revision-No	REVISIONS Index	Date / Name	A03	F67252
x1 388 032 67	-------	A	25.09.98/NTS		Date / Name
x2 388 032 68	-------	B	04.02.99/NTS	DRAWN	25.02.98/NTS
x3	-------	C	02.03.99/NTS	APPROVED	09.03.98/NTS
x4	ECO-062920	D	13.01.00/NTS		
x5				ISSUED	N. SCHNURR

[1997, 8, 11, 2]
$USER_CAE_B/cardiosmart_ci/control_ci/design/control_core

MEMORY

BOOT FLASH, lower
Organisation x32

BOOT FLASH, upper
Organisation x32

FLASH 1, lower
Organisation x32

FLASH 1, upper
Organisation x32

DRAM 1, lower
Organisation x32

DRAM 1, upper
Organisation x32

ECG SRAM buffered

Option Serial EEPROM

Option Serial RTC

MEMORY CONFIGURATION

Memory Configuration Bit
"DRAM_32B" = "Low"
indicates
Hardware Version V1.1

ADDRESS(31:0)
CONTROL(CO_E:0)
DATA(31:0)

Marquette Hellige GmbH D-79007 Freiburg						388 032 67-D05	Sheet: 5 of 10
Not equipped in Version :		REVISIONS Revision-No	Index	Date / Name	A03	F67252	
x1	388 032 67	------	A	25.09.98/NTS		Date / Name	SCHEMATIC
x2	388 032 68	ECO-062920	B	13.01.00/NTS	DRAWN	04.03.98 / NTS	STEUERUNG CS_CI
x3					APPROVED	09.03.09/NTS	
x4							
x5					ISSUED	N. SCHNURR	

[1997, 8, 11, 2]
CS

Schutzvermerk nach DIN 34 beachten

CONTROL(CO_E:0)

CONTROL/STATUS REGISTER

74ABT16374 Z32 · 74LVC32 Z29 · 74HCT14 Z23 · 74LVC16244 Z30 · 74LVC16244 Z34

DATA(31:0)

ECG_INTERFACE

ECG_BUS(6:0)

74HCT14 Z9 · 74HCT125 Z7 · ISPLSI1016 Z13

KEYBOARD INTERFACE

74ABT16374 Z32 · 74LVC32 Z29 · 74LVC16244 Z30

KEYB/ 1 · KEYB/ 2 ON_OFF · KEYB/ 19 KB_CONF1 · KEYB/ 21 KB_CONF2

KEYB/ 3 COL 1 · KEYB/ 5 COL 2 · KEYB/ 7 COL 3 · KEYB/ 8 COL 4 · KEYB/ 10 COL 5 · KEYB/ 11 COL 6 · KEYB/ 12 COL 7 · KEYB/ 13 COL 8 · KEYB/ 14 NC

KEYB/ 4 ROW 1 · KEYB/ 6 ROW 2 · KEYB/ 9 ROW 3 · KEYB/ 15 ROW 4 · KEYB/ 16 ROW 5 · KEYB/ 17 ROW 6 · KEYB/ 18 ROW 7

KEYB/ 24 LED_LIN · KEYB/ 25 LED_STOP · KEYB/ 26 LED_START · KEYB/ 20 LED_GND · KEYB/ 22 LED_SUPPLY · KEYB/ 23 LED_BATT

BUZZER

FTMB05 LS1 · BC847B T23

RS232 INTERFACE

Enable Modem Supply · BC847B T34 · BAS85 D93 · ADM202EARU Z4 · SMBJ15C D92

RS232/1 CDE · RS232/2 RXDE · RS232/3 TXDE · RS232/4 DTRE · RS232/5 GND · RS232/6 V_MODEM · RS232/7 RTSE · RS232/8 FERNST/CTSE · RS232/9 EKGTRIG

Option IRDA

TFDS3000 X8 · BC847B T8 · BC847B T11

OPTION RS232 EXTENSION

RS232_E/ 1 · RS232_E/ 2 · RS232_E/ 3 · RS232_E/ 4 · RS232_E/ 5 · RS232_E/ 6 · RS232_E/ 7 · RS232_E/ 8 V_MODEM · RS232_E/ 9 EKGTRIG_E · RS232_E/ 10 FERNST_E

INTERFACE

Marquette Hellige GmbH	D-79007 Freiburg
388 032 67-D06	Sheet: 6 of 10
SCHEMATIC	
STEUERUNG CS_CI	

Not equipped in Version :		REVISIONS Revision-No	Index	Date / Name	A03	F67252
x1	388 032 67	------	A	16.09.98/NTS		Date / Name
x2	388 032 68	------	B	04.02.99/NTS	DRAWN	04.03.98/NTS
x3		ECO-063901	C	14.12.99/NTS	APPROVED	09.03.98/MSG
x4		ECO-062920	D	13.01.00/NTS		
x5					ISSUED	N. SCHNURR

Schutzvermerk nach DIN 34 beachten

[1997, 8, 11, 2]
$USER_CAE_B/cardiosmart_ci/control_ci/design/interface

1/4 VGA COLOR KYOCERA

DISPLAY DRIVER

VGA TFT COLOR

1/4 VGA MONOCHROME HOSIDEN

+26V SWITCHING REGULATOR

-23V GENERATION

INVERTER BACKLIGHT

DISPLAY_INTERFACE

Schutzvermerk nach DIN 34 beachten

Marquette Hellige GmbH D-79007 Freiburg	388 032 67-D07
	Sheet: 7 of 10
SCHEMATIC	
STEUERUNG CS_CI	

Not equipped in Version :		REVISIONS Revision-No	Index	Date / Name	A03	F67252
x1	388 032 67	------	A	25.09.98/NTS		Date / Name
x2	388 032 68	ECO-062920	B	13.01.00/NTS	DRAWN	04.03.98/NTS
x3					APPROVED	09.03.98/NTS
x4						
x5					ISSUED	N. SCHNURR

[1997, 12, 16, 3]
$USER_CAE_B/cardiosmart_ci/control_ci/design/display_interface

PRINTHEAD INTERFACE

HEATING CONTROL

TEMPERATURE MONITORING

TPC DOT CONTROL

TPC POWER CONNECTOR

MOTOR CONTROL

PRINTER CONTROL

TPC DATA

MARK READER 1

US Paper

MARK READER 2

CONTROL(CO_E:0)

DATA(31:0)

CPLD(CPLDMAX:0)

ISPLSI1016 Z2

IDT7201-35 Z11

IDT7201-35 Z10

74LVC32 Z15

74HCT14 Z1

LM339D V1

LMC660CM V4

LM393D V13

TL431ACD [SHUNTREG] V7

TCA3227G

BC847B T16

BC847B T18

IRFR9024 T14

IRF7301 T33

BSS84 T15

Schutzvermerk nach DIN 34 beachten

Marquette Hellige GmbH D-79007 Freiburg						388 032 67-D08	Sheet: 8 of 10
Not equipped in Version :		REVISIONS Revision-No	Index	Date / Name	A03	F67252	
x1	388 032 67	------	A	25.09.98/NTS		Date / Name	
x2	388 032 68	------	B	04.02.99/NTS	DRAWN	04.03.98/NTS	SCHEMATIC
x3		ECO 062920	C	13.01.00/NTS	APPROVED	09.03.98/NTS	STEUERUNG CS_CI
x4							
x5					ISSUED	N. SCHNURR	

[1997, 8, 11, 2]

$USER_CAE_B/cardiosmart_ci/control_ci/design/printer_control

Interface Power Supply

+24VPS: POSUP/ 1, POSUP/ 2 — L8 0u43 — +24V
GNDPS: POSUP/ 3, POSUP/ 4 — quad ferrite L8 0u43 — GND24V

+24V → STPS340S D1 → +USUPP
STPS340S D2 → +5VSTB

Interface Battery

+24V: BATT/1, BATT/2, BATT/3
BATT/4 Code, BATT/5 NC
GND: BATT/6, BATT/7, BATT/8, BATT/9 → GND24V
x1,x2 470P C3, R3 0R → GND24V
+UBATT: BATT/10, BATT/11, BATT/12, BATT/13 → +UBATT
BATT/14 → +UBATT_ME
BATT/15 Code
+5V_L: BATT/16 — L2 0u1 — +5V
BATT/17 NC — R495 10K
BATT/18 → BATT_OPT_
BATT/19 → LOAD_OFF
BATT/20 NC
CONTROL(CO_E:0)

ON/OFF CONTROL

+USUPP → IRFR9024 T2 (gate 100K R5, 68K1 R8) → +UBATT_SW
1U C288
STPS340S D4 → +UVERS
STPS340S D3 → +USUPPME
IRFR9024 T3 (100K R21, 100K R28, 1U C289, 0U1 C20, 68K1 R40) → +USUPPSW

+5VSTB: 100K R96, 10K R59
CD4093BCM Z3 (10K R84, 10N C56, D14 BAS32)
221R R80 → CD4013BCM Z5 (S, C1, 1D, R, VCC, GND)
CD4093BCM Z3 (4K75 R51, 100K R55, 1U C46)
CD4093BCM Z3 → T29 BC847B, T4 BC847B (R61 22K1, 3K32 R57)
ONOFF_SW_

Interface Modem Supply

+UVERS: MO_SU/ 1, MO_SU/ 2, MO_SU/ 3
x1,x2 R813 10K → GND24V

+5V SWITCHING REGULATOR

GND15V: R48 100R, R39 3K16, R19 100R, 3n3 C23, R27 10K
+UVERS: 0U1 C12, 249K R10, LM2595S-ADJ (VIN, OUT, ON_OFF, GND, FB)
R14 0R, C280 4u7, C281 4u7, C4 220U, C7 0U1, R13 475R, R53 0R, R62 0R, R63 0R
L16 47u
STPS340S D5
C35 100u, C25 100u, C26 0U1
+5V → STPS340S D10 → +3.3V

+3,3V SWITCHING REGULATOR

GND13V: R20 274R, R23 5K76, R44 100R, 3n3 C37, R33 10K
+UVERS: LM2595S-ADJ (VIN, OUT, ON_OFF, GND, FB)
R70 0R, C282 4u7, C283 4u7, C10 220U, C16 0U1, L19 47u, R67 0R, R64 0R, R65 0R
STPS340S D6
C41 100u, C33 100u, C36 0U1
+3.3V

+ 3.3V STANDBY supply

+USUPP → 5K76 R737
BZV55B6V8 D26 (0R R679, 0U1 C97, 10U C95, x1,x2 R157 100K)
MAX1615EUK-T (VIN, SHDN_, 5_3_, GND, VOUT, V9)
R137 0R, 4U7 C105
D31 BAS32, D32 BAS32, D33 BAS32, D74 BAS32
+3.3VSTB → 4U7 C104

+12V Generation

+UVERS: R161 0R, 0U1 C103
LP2951CM (VIN, FB, VTAP, SHDN, GND, VOUT, SENSE, ERROR_)
x1,x2 R190 0R, 0R R680
49K9 R169, 10N C102, 5K76 R163, 10U C106
+12V → R180 0R

+ 22,5 V PRINTER SUPPLY

BSS84 T17 (100K R139, 100K R138)
T12 BC847B (R120 22K1, 3K32 R141)
82K5 R142, BAS32 D19, 10K R143, 0U47 C73
ADC0831CCN X6 (CS_, CLK, VCC, GND, VINT+, VINT-, DO, VREF)
TL431ACD V6 [SHUNTREG] (R110 1K) — BATTERY VOLTAGE MONITOR

OPTION PUMP

+UVERS → D82 BYM10-100 → LM317S VREG V5 (ADJ, R107 4R7, R108 4R7, R106 4R7) → +UPUMP
0U1 C55
BYM10-100 D81, BYM10-100 D80, L35 0u1 NC
PUMP/ 1, PUMP/ 2, PUMP/ 3, PUMP/ 4
L28 0u1, R94 0R

VOLTAGE CONTROL

T5 BC847B (R47 10K, R46 10K) ← DEV_OFF
T9 BC847B (R103 4K75, 0U1 C65, 22K6 R118)
T6 BC847B (R76 33K2, 100K R81) ← REG_OFF_
+5V → ZMM4.7 D78 (x1,x2, 20K R687) → CD4093BCM Z3 (12, 13, 11)
10K R673 → 100K R660
T30 BC847B (R695 4K75, 100K R674)
LINE_ON, EN_MOSU
LM339D V3 (2K43 R82, 10K R43, 1K R684, 3K65 R706, 10U C47, 20K R686, 20K R25, 549R R42, 10U C28, 3K65 R26, 332R R38)
R83 10K, R54 10K, R69 10K
REG_ON, BATT_LEV2, BATT_LEV1, REG_OFF_, SPICLK2L, ENSPI2L, SPIMISO, LED_LIN, DEV_OFF

+ 22,5 V PRINTER SUPPLY

+USUPPSW → Uin
REG_ON → ON/OFF Control
Uout 1 → +USUPPME
Uout 2 → +22.5V_M
Sheet 10/10

+5VSTB: R102 10K → CD4013BCM Z5 (S, C1, 1D, R, VCC, GND)
+5V: 10K R50 → LM339D V3

+5V: 0U1 C39, 0U1 C85
+5VSTB: 0U1 C72, 0U1 C52

POWER SUPPLY

Marquette Hellige GmbH D-79007 Freiburg						388 032 67-D09	Sheet: 9 of 10
Not equipped in Version :		REVISIONS Revision-No	Index	Date / Name	A03	F67252	
x1	388 032 67	------	A	25.09.98/NTS		Date / Name	SCHEMATIC
x2	388 032 68	------	B	04.02.99/NTS	DRAWN	03.02.98/NTS	
x3		ECO-062289	C	21.06.99/MSG	APPROVED	09.03.98/NTS	STEUERUNG CS_CI
x4		ECO-063901	D	14.12..99/NTS			
x5		ECO-062920	E	13.01.00/NTS	ISSUED	N. SCHNURR	

Schutzvermerk nach DIN 34 beachten

[1997, 8, 11, 2]
$USER_CAE_B/cardiosmart_ci/control_ci/design/power_supply

CONTROL(CO_E:0)

REG.ON

ON/OFF Control

Enable = High
Disable = Low

Output 1

Input

Output 2

+USUPPME

+USUPPSW

+22.5V_M

R88 49R9

R60 1M5

R117 0R033

43n L43

43n L40

47u L31

220U C79 x1,x2

4u7 C284

4u7 C286

0U1 C48

GND22V

f=200KHz

LTC1435CS

1	COSC	TG	16
2	RUN_SS	BOOST	15
3	ITH	SW	14
4	SFB	VIN	13
5	SGND	INTVCC	12
6	VOSENSE	BG	11
7	SENSE-	PGND	10
8	SENSE+	EXTVCC	9

X5

33R2 R115

1n C279

IRLR024 T7

0U1 C67

BYM13-30 D17

MBRS360T3 D8

2u2 C44

47u L21

0R033 R72

L20 43n

L30 43n

4u7 C43

4u7 C42

4u7 C285

0U1 C32

GNDITPC

10P C68

47P C64

0U1 C59

GND22V

4K75 R111

0U1 C63

2N2 C58

0U1 C62

1n C51

100p C54

3n3 C29

V2

IN+ IN- VCC GND PROG IOUT AVG SENSE

LT1620CS8

0U1 C30

22N C40

R705 100R

0U1 C38

R35 4K02

31K6 R707

R34 1M

100R R75

L12 43n

GND24V

GND22V

100p C31

R36 1K87

R37 33K2

4u7 C76

1R R92

2K21 R135

D79 ZMM4.7

R149 1K

10N C278

R165 475R

0U1 C99

R146 1M

LM358D

V8

100R R704

68K1 R697

49R9 R66

0U1 C91

1K R150

LM358D

V8

1K R158

3K16 R166

49R9 R41

49R9 R31

Schutzvermerk nach DIN 34 beachten

PRINTER SUPPLY

Marquette Hellige GmbH D-79007 Freiburg						388 032 67-D10	Sheet: 10 of 10
Not equipped in Version :		REVISIONS Revision-No	Index	Date / Name	A03	F67252	
x1	388 032 67	------	A	14.09.98/NTS		Date / Name	
x2	388 032 68	ECO-062920	B	13.01.00/NTS	DRAWN	04.03.98/NTS	SCHEMATIC
x3					APPROVED	08.03.98/NTS	STEUERUNG CS_CI
x4							
x5					ISSUED	N. SCHNURR	

[1998, 1, 26, 2]
$USER_CAE_B/cardiosmart_ci/control_ci/printer_supply

BT-AS: 0
BT-BS: 1332
LOET-AS: 325
LOET-BS: 4217

91541485
91541773
91541326
Code
44201010
91541533
91541781
44200120
Code
glued on top
and bottom
oben und unten
geklebt
91542058
91541485
4/91541480
Code
4/44201005
92723057
BA1
do not remove
upper cover foil
obere Deckfolie
nicht entfernen
91541772
43367252
92723057
WAVE
REFLOW
91542045
3/91618903
91542035
43252568
2x 80177736
tin-free
zinnfrei
2 fixations with
sealing glue
82907300
2x fixiert mit
Dichtungskleber
82907300
V16, V17, V18, V20 (14-pin)
placed in direction of pin 1
in Richtung Pin 1 platziert
Code
Code

MOTOR/ HOS_BL/ SHARP_BL/ POSUP/ BATT/ MO_SU/ RS232_E/ RS232/ TPC_DAT/ TPC_P0/ MARK1/ MARK2/ BDM/ JTAG/ ISP/ KY0/ HOS/ KEYB/ EKG/ LED1 LED2 LED3 LED4 PUMP/ Barcode

Schutzvermerk nach DIN 34 beachten.

Marquette Hellige GmbH D-79007 Freiburg				38803267-D11 1 / 1
REVISIONS				A03 43367252
Revision-No	Index	Date/Name		Date/Name
---	B	04.02.99/MSG		
---	C	02.03.99/MSG	Drawn	09.03.98/MSG
ECO-062289	D	21.06.99/MSG	Approved	10.03.98/NTS
ECO-063901	E	14.12.99/MSG		
ECO-062920	F	13.01.00/MSG	Issued	N.SCHNURR
				REF DWG
				STEUERUNG CS_CI

BT-AS: 0
BT-BS: 1332
LOET-AS: 325
LOET-BS: 4217

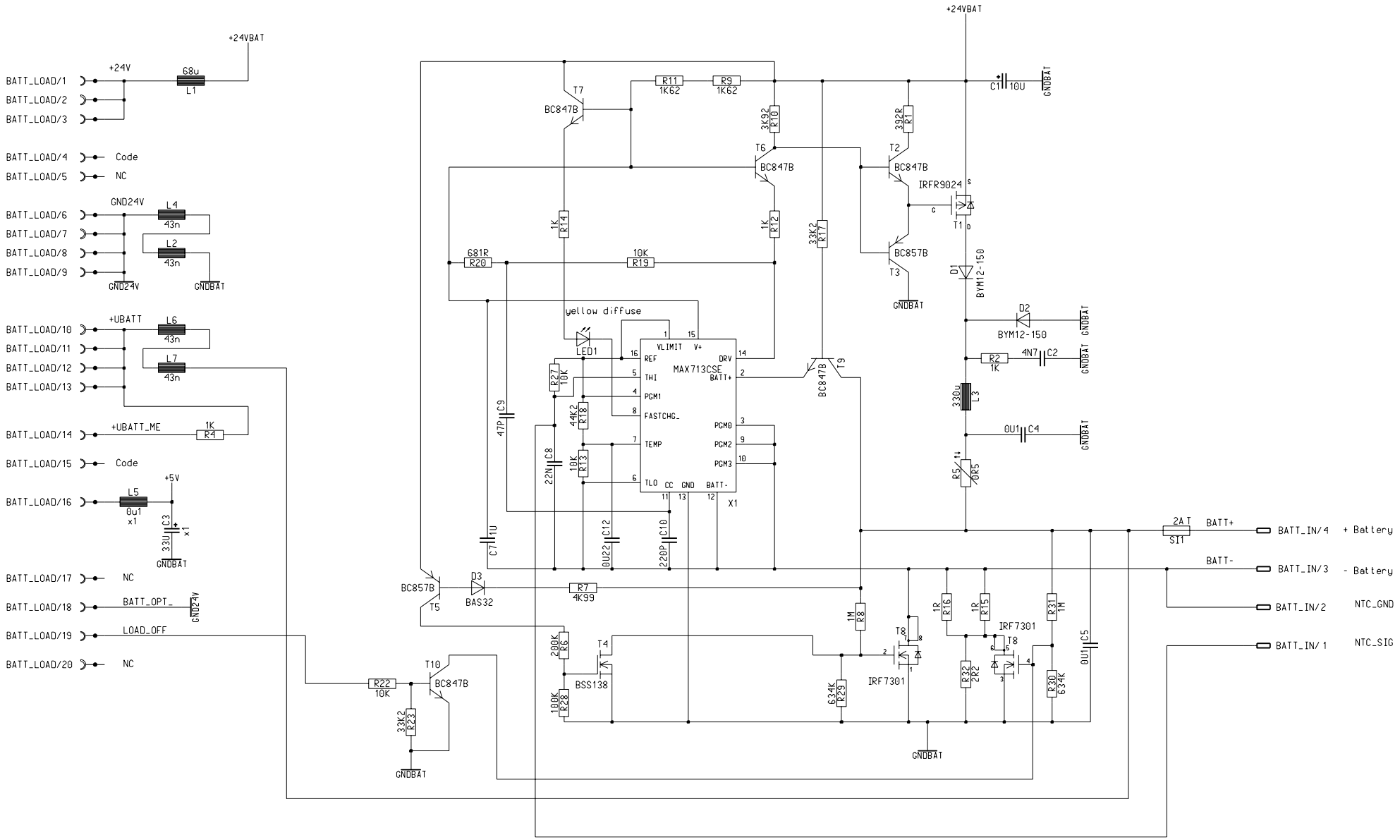
91541485
91541773
91541326
Code
44201010
91541533
91541781
44200120
Code
glued on top
and bottom
oben und unten
geklebt
tin-free
zinnfrei
two fixations with
sealing glue
82907300
2x fixiert mit
Dichtungskleber
82907300
91541772
91541485
2/91541480
Code
4/44201005
92723057
BA1
do not remove
upper cover foil
obere Deckfolie
nicht entfernen
92723057
WAVE
REFLOW
43367252
91542045
3/91618903
91542035
43252568
2x 80177736
Code
V16, V17, V18, V20 (14-pin)
placed in direction of pin 1
in Richtung Pin 1 bestuecken
Barcode
XXXXXXXXXX
xxx xxx xx xxxx x

MOTOR/
HOS_BL/
X3
POSUP/
BATT/
MO_SU/
RS232_E/
RS232/
TPC_DAT/
TPC_P0/
HOS/
MARK2/
BDM/
JTAG/
ISP/
KEYB/
PUMP/
EKG/
LED1
LED2
LED3
LED4

Schutzvermerk nach DIN 34 beachten.

Marquette Hellige GmbH D-79007 Freiburg				38803268-D01 1 / 1
REVISIONS				AO3 43367252
Revision-No	Index	Date/Name		Date/Name
---	A	04.02.99/MSG		
---	B	02.03.99/MSG	Drawn	05.10.98/MSG
ECO-062289	C	21.06.99/MSG	Approved	05.10.98/NTS
ECO-063901	D	14.12.99/MSG		
ECO-062920	E	13.01.00/MSG	Issued	N. SCHNURR

REF DWG
STEUERUNG CS_CI



Schutzvermerk nach DIN 34 beachten

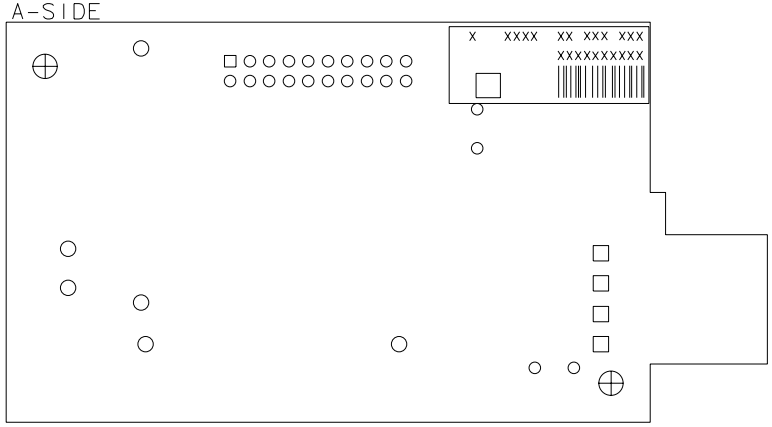
Marquette Hellige GmbH D-79007 Freiburg					388 032 90 - D01	Sheet: 1 of 1
Not equipped in Version :	REVISIONS			A03	F67267	
	Revision-No	Index	Date / Name		Date / Name	
x1 388 032 90	---	A	03.08.98 VRP			
x2	---	B	23.09.98 VRP	DRAWN	31.07.98/VRP	Schematic
x3	ECO-062727	C	24.06.99 HAW	APPROVED	31.07.98/NTS	
x4	ECO-062920	D	26.01.00 MSG			Akku-Ladung CS_CI
x5				ISSUED	N. Schnurr	

[1998, 3, 12, 5]
$USER_CAE_B/cardiosmart_ci/batload_ci/design

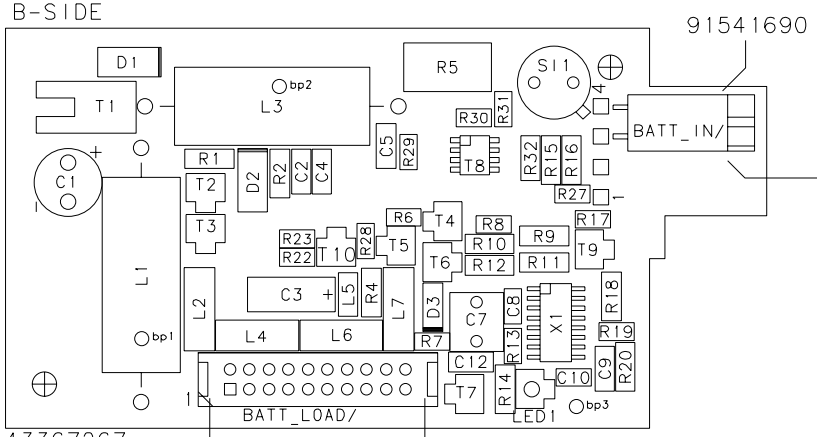
Schutzvermerk nach DIN 34 beachten.

BT-AS: 0
BT-BS: 53
LOET-AS: 34
LOET-BS: 114

A-SIDE



B-SIDE



91541690

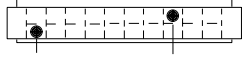
glued
geklebt

REFLOW

43367267

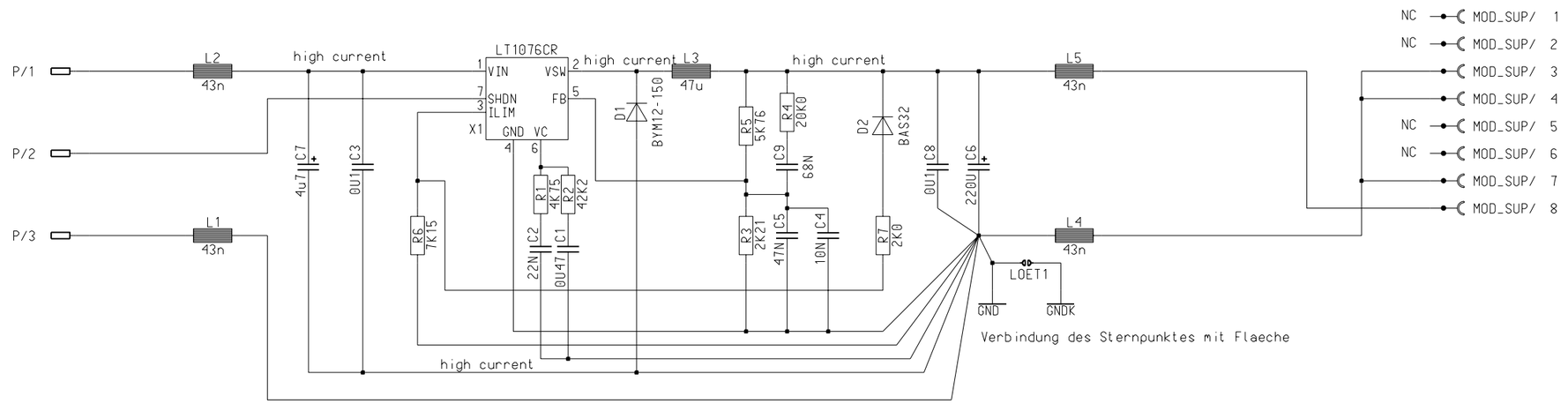
CABLE ASSY 38327394

WAVE



coded from bottom side
codiert auf Unterseite

Marquette Hellige GmbH D-79007 Freiburg				38803290-D02 1 / 1
REVISIONS				AO4 43367267
Revision-No	Index	Date/Name		Date/Name
----	A	03.08.98/MSG		
----	B	29.09.98/HAW	Drawn	17.04.98/MNS
062920	C	26.01.00/MSG	Approved	17.04.98/MSG
			Issued	M. Steinle
REF DWG				
Akku-Ladung CS_CI				



Schutzvermerk nach DIN 34 beachten

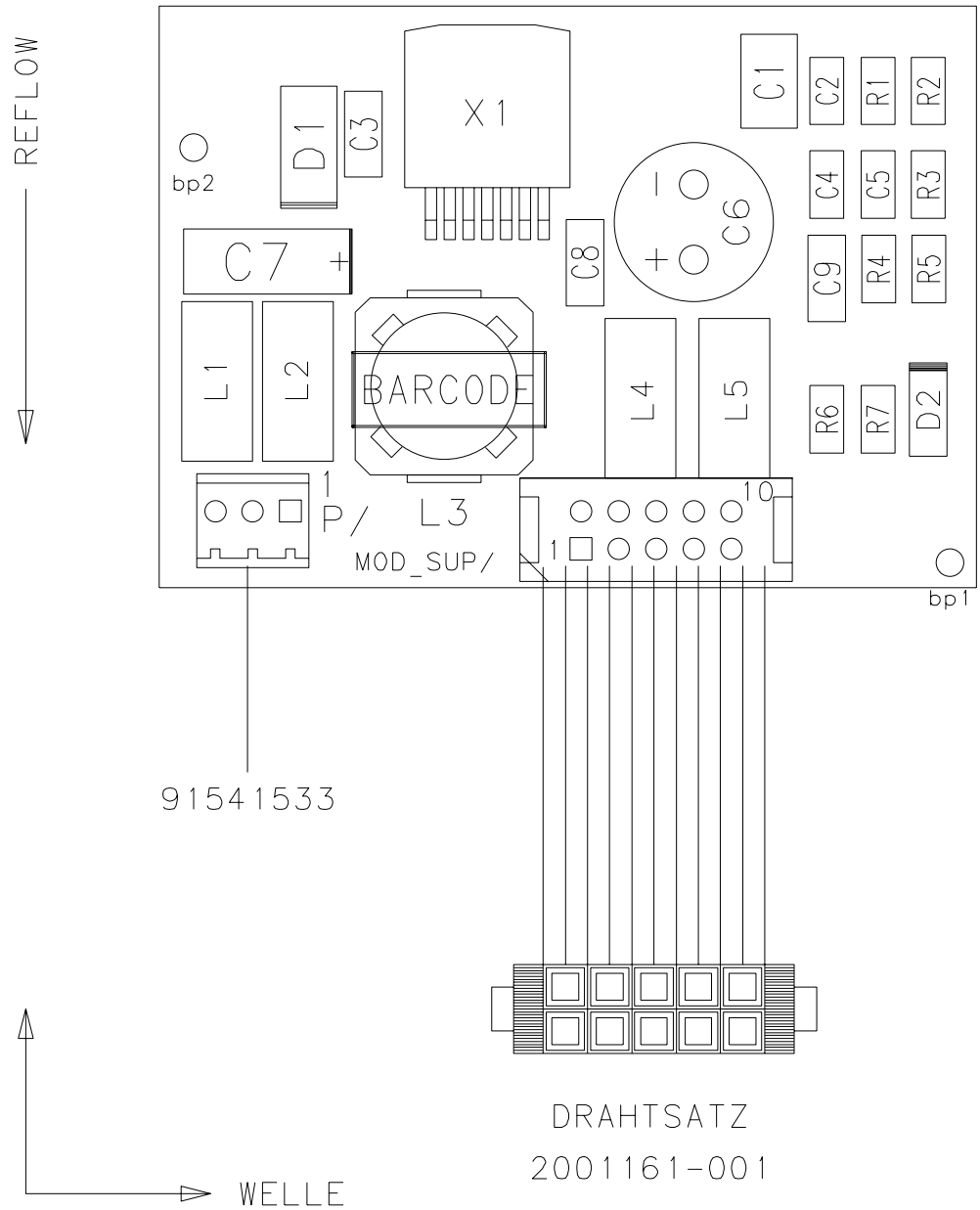
Marquette Hellige GmbH D-79007 Freiburg						2000772-001 Sheet: 1 of 01
Not equipped in Version :		REVISIONS Revision-No	Index	Date / Name	A03	2000770-001
1)	2000771-001	ER20593	1	09.06.99/VRP		Date / Name
2)		ER20816	2	20.07.99/HAW	DRAWN	09.06.99/VRP
3)		ECO-062920	A	23.12.99/NTS	APPROVED	09.06.99/NTS
4)						
5)					ISSUED	V.PLACKE

SCHEMATIC PCB

MODEM SUPPLY CS_M

[1999, 6, 9, 4]
$USER_CAE_A/modem/design

BT-AS = 0
BT-BS = 27
Loet-AS = 15
Loet-BS = 53



Marquette Hellige GmbH D-79007 Freiburg				2000771-002 1 / 1
REVISIONS				A04
Revision-No	Index	Date/Name		2000770-001
ER20593	1	21.06.99/HAW		Date/Name
ER20816	2	20.07.99/HAW	Drawn	21.06.99/HAW
ECO-062920	A	12.01.00/MSG	Approved	21.06.99/MSG
			Issued	N.Weiss

DOC REF DWG
MODEM SUPPLY CS_M

Schutzvermerk nach DIN 34 beachten.

marquette

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